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Review

The Intention to Use Fitness and Physical Activity Apps: A Systematic Review

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Abstract: Recently the development of new technologies has produced an increase in the number of studies that try to evaluate consumer behavior towards the use of sports applications. The aim of this study is to perform a systematic review of the literature on the intention to use mobile applications (Apps) related to fitness and physical activity by consumers. This systematic review is a critical evaluation of the evidence from quantitative studies in the field of assessment of consumer behavior towards sport applications. A total of 13 studies are analyzed that propose models for evaluating the intentions to use fitness applications by sport consumers. The results revealed several key conclusions: (a) Technology Acceptance Model is the most widely used model; (b) the relationship between perceived utility and future intentions is the most analyzed; and (c) the most evaluated applications are diet/fitness. These findings could help technology managers to know the most important key elements to take into account in the development of future applications in sport organizations.

Keywords: physical activity; sport application; marketing consumption; technology acceptance model; smartphone app

1. Introduction

The constant technological evolution and the development of new mobile devices such as Smartphones or tablets offer a higher level of comfort and practical use, thus making this type of device the center of life for current consumers [1]. Globally, it is estimated that in 2019, there were 6.8 billion users worldwide and it is expected that in 2023 the number of users will increase to 7.33 billion [2]. In particular, 90% of the time dedicated to the Smartphone is for the use of mobile applications (Apps) [3].

Sustainability takes equal account of economic, environmental and social factors in any effort to improve quality of life [4]. The dissemination and integration of information and communication technologies (ICT) and data management functionalities have been widely leveraged through the adoption of mobile devices, which allow people to participate in a larger way in society [5,6]. European Union (EU) policies emphasize the synergy between smart technologies and sustainable urban development because of the need for accurate, consistent and timely data for new policy formulation and the use of ICTs to facilitate service improvement [7,8].

The role of ICTs in sustainable development is clearly reflected in Goal 11 "make cities and human settlements inclusive, safe, resilient and sustainable" of the Sustainable Development Goals of the

United Nations Agenda 2030 [9], which considers ICTs as a means to advance human progress and knowledge in societies, to increase resource efficiency, to promote economic development and protect the environment or to modernize industries on the basis of sustainable design [9,10]. Online tools and platforms contribute significantly to the repression of energy demands or pollution, promoting cities to a more environmentally sustainable economy [11]. Angleidou et al. [7] show that ICTs and the use of Apps help reduce the need for physical travel and the existence of physical workplaces.

An App is defined as "software applications usually designed to run on a Smartphone or tablet device and provide a convenient means for the user to perform certain tasks" [12] (p. 211). The increase is such that Blair [13] reported that the trade of Apps generates 189 billion dollars a year being used at least 11 times by 49% of users while 21% of the millennials open them at least 50 times a day.

Among them, health, fitness and physical activity Apps represent 5.18% of the total market [14], being used daily by 35% of people and several times a week by 40% [15]. In recent years, McKay, Wright, Shill, Stephens, and Uccellini [16] report a proliferation of Apps to improve health, including Apps to count the steps or promote physical activity in fitness centers, Apps to control diet and caloric intake or reduce poor habits such as smoking or alcohol consumption and improve mental health.

This increase in interest and number of Apps associated with physical activity could also have benefits for society. Therefore, the current situation of confinement caused by Covid-19 and consequently the reduction of physical activity, has encouraged different organizations such as the World Health Organization [17] to promote the need for physical activity at home. In fact, authors such as Banskota, Healy, and Goldberg [18] proposed different Apps as tools to maintain and improve physical and mental fitness in the Covid-19 pandemic. These Apps are linked to the fitness sector, revolutionizing the ways of doing physical activity and the relationships between fitness providers and consumers [19].

These new communication and prescription tools in sport could therefore have an impact on how organizations interact with consumers, with the appearance in recent years of studies that evaluate consumers' motivations for using devices, the usefulness of Apps or consumers' intentions to adopt them in different areas [20,21]. Particularly, researchers have begun to identify the factors that lead to the intention to use technologies, Smartphones and Apps in different sectors [22,23], but it is limited in the sports context.

Among the theories related to the intention to use of technologies, in the context of marketing we find the "Theory Acceptance Model" (TAM). This is the most used model by researchers to evaluate the intention to use of new technologies proposed by Davis [24]. TAM is an adaptation of the psychological theory, the "Theory of Reasoned Action" (TRA), which states that a person's real behavior is determined by his or her intention to perform that behavior [25]. For instance, the TAM tries to explain how consumers use and accept new technologies based on two key beliefs, namely the usefulness of use and the ease of use that are predictive of consumers' attitude towards future intention to use the new technologies [24]. Research based on TAM is one of the most widely used in professional settings because it focuses on the utilitarian aspect of the technology [26], with the intention of understanding the consumer's intention to use it [22]. In particular, TAM has been used in different contexts such as finance, instant messaging, healthcare, gaming and tourism [27].

Although TAM has great robustness and applicability in terms of intention to use, attitude and perceived utility [27], different authors have developed new theories based on TAM such as the "Innovation and Diffusion Theory" (IDT) [28] which considers that the user's behavioral potential is driven by the user's beliefs about innovation. Later, there is the "Unified Theory of Acceptance and Use of Technology Model (UTAUT)" [29] that proposes four constructs to develop TAM: performance expectation, social influence, effort expectation and facilitation conditions. A second version of this model (UTAUT2) adds the constructs of hedonic motivation, price and habit, being adapted by Yuan, Ma, Kanthawala, and Peng [30] to measure the intention to use of health and fitness Apps. In addition, in sport, the "Sport Website Acceptance Model" (SWAM) is proposed by Hur, Ko, and Claussen [31] and is based on a framework of understanding how sport fans perceive and accept the websites of

their sport teams, how their level of participation and commitment to the sport team influences the intention to use the website and the actual consumption behavior they ultimately perform. Based on these models and theories, in recent years researchers have paid attention to the intention to use new technologies in different contexts such as e-payment, e-government, e-banking, retail or education [32–36]. Similarly, in academic sports literature there is also an increasing attention to the behavior of fans and consumers, with studies with different approaches such as motivation on sports websites [31], loyalty [37], participation, commitment and attributes [38,39], marketing opportunities [40], intention to use sports wearable [41], consumption of Smartphones and sports Apps [42], sports team Apps [1], fitness Apps [43,44] and sports products [45,46].

However, existing research does not provide clear results on what factors drive sports fans or consumers to use Smartphones or Apps and to benefit from new forms of experiences in sport [42]. In fact, the factors influencing the intention to use Smartphones and Apps differ depending on the types of products consumed and the marketing implications [47]. Therefore, while studies have been conducted on the intentions of use of technology, Smartphones and fitness Apps, there is not a review that captures the main findings of these studies. For this reason, the aim of this study is to conduct a systematic review of the literature on consumers' intention to use Apps related to fitness and physical activity by consumers.

2. Materials and Methods

2.1. Search Strategy

The search terms for Smartphone use, Fitness and Sport Apps represented the concepts of App, Physical Activity and Use, with the search strategy for the different databases presented in Table 1. Different databases were selected to include a wide range of areas related to this interdisciplinary study, including sports science, marketing, health and psychology. The databases used were Web of Science, Scopus, SPORTDiscus (EBSCO), PsycINFO (Ovid), ABI/Inform (Ovied) and MEDLINE (Pubmed). The search was conducted between 18 March 2019 and 4 August 2020. The search covered all years and no limitations were placed on document type and language.

Table 1. Database search strategy.

Category	Search Terms
App	("Smart phone *" or Smartphone * or smart-phone * or "cell * phone" or "cell-phone *" or "mobile phone *" or "mobile-phone" or "mobile device" or "mobile telephone" or * phone or Android * or iOS or app or apps or "mobile application *" or application)
Physical Activity	("physical activit *" or exercise * or "active living" or walk * or "active transport" or "leisure activit *" or fitness or sport or "sport *" or "weight maintenance" or "maintaining weight" or "weight management")
Use	("intention to use" or "app * usage" or "intent * to use" or usage or "behavioral intention *" or "behavior * change" or usability or "attitude toward" or consumption or Technology Acceptance Model)
Combination	1 and 2 and 3

* Truncation operator: word-based search.

2.2. Inclusion and Exclusion Criteria

For the purposes of this review, we included empirical papers in peer-reviewed journals, excluding dissertations and abstracts. Grey literature was not included, ruling out evaluation reports, annual reports, articles in nonpeer reviewed journals and other means of publication. The inclusion criteria for the articles in the search were: (i) journal articles; (ii) publications in English; (iii) use of any type of mobile application in the sports and fitness context; and (iv) measurement of the intention to use the App through a questionnaire. As exclusion criteria have been used: (i) Congress proceedings, book chapters, books or other types of publications; (ii) no mobile Apps were used in the sports context,

(iii) theoretical studies, qualitative approach or reviews; (iv) articles in a language other than English; and (v) duplicate articles.

2.3. Assessment of Methodological Quality

The risk of bias was assessed using a 20-item tool adapted by the authors to the context of sports marketing study typology in which there are no intervention processes on the subjects of the Consolidated Standards of Reporting Trials (CONSORT) checklist [48]. Each study was independently scored by two reviewers evaluating the different sections that make up the studies and scoring each item with 1 if the study satisfactorily met the criterion, and with 0 if the study did not satisfactorily meet the criterion or if the item was not applicable to the study. Disagreements between the reviewers were resolved by checking and discussing the original study until consensus was reached. Reviewer A is a researcher with extensive experience specializing in the field of sports management, fitness centers and development of new technologies. Reviewer B is a predoctoral fellow in sports management with focus research on methodological and statistical aspects. The results of assessment of methodological quality were shown in Appendix A.

2.4. Data Extraction and Synthesis

Figure 1 shows the Flow Diagram proposed by Moher, Liberati, Tetzlaff, and Altman [49] following the PRISMA methodology in all points that could be common to a systematic review of these characteristics. The initial database search returned 113,537 results, reduced to 36,105 once duplicates were eliminated. One reviewer conducted a full scan of the title, then an abstract review and finally a full text review using the inclusion and exclusion criteria. Among the articles that remained at the abstract level ($n = 4$), a second reviewer also examined the abstracts of the articles to confirm their eligibility, and there were no discrepancies with the first reviewer.
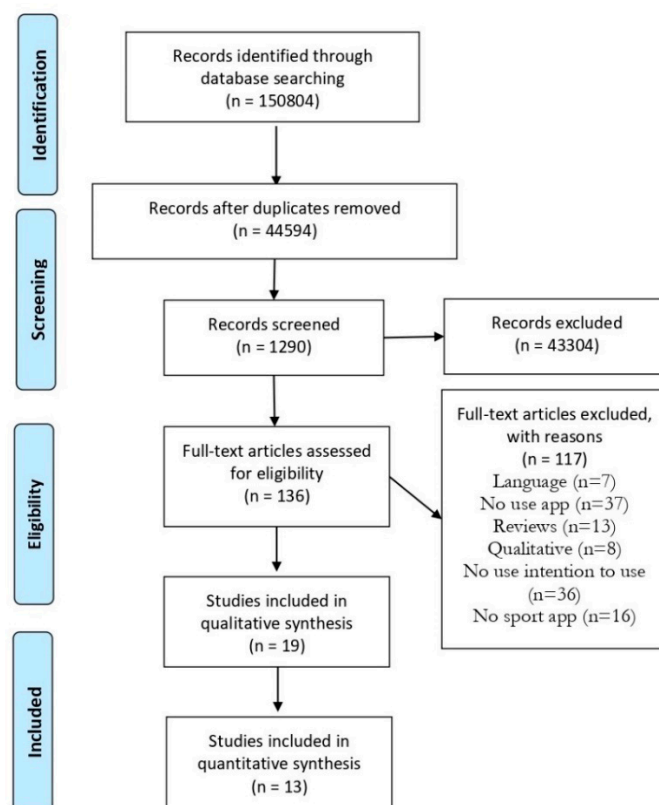

Figure 1. PRISMA flow diagram. Source: Moyer et al. [49].

A form was developed for data extraction that included the following aspects: (a) year of publication; (b) country of study; (c) number of participants; (d) gender; (e) age of participants; (f) type of application evaluated; (g) theory used; (h) analyses performed; (i) variables included; and (j) main results. In order to homogenize the results of the different studies and to make the data more homogeneous, the confidence intervals of each correlation (CI 95%) and the effect size with its confidence intervals (CI 95%) of each relationship were calculated through the Fisher's Z statistics [50].

3. Results

3.1. Analysis of the Risk of Bias in Studies

To test quality, risk of bias analysis of the 19 studies evaluated in the research showed that only three studies had a high score of 15 points or more out of 20 total [1,45,51], most studies (*n* = 14) had a mean score between 10 and 15 points and only two studies had a score below 10 points [52,53]. It should be noted that none of the studies analyzed carried out a calculation of the sampling required for the generalization of the results, which could be due to the fact that all the studies carried out a selection of the sample for convenience within a certain population. There are also few studies that established criteria for inclusion in the sample to be selected (*n* = 5) and no study indicates the author who carried out each part of the research.

3.2. Summary of Reported Intervention Outcomes

Results of the descriptive data from the analysis of the articles can be seen in Table 2. The analysis shows that this topic is very recent within the context of sports marketing, with only 13 quantitative studies addressing the intention to use of sports applications by the sports consumer through the use of self-administered questionnaires and online. Of the articles analyzed, the majority were published in 2018 (*n* = 5) and 2020 (*n* = 5), followed by those published in 2017 (*n* = 4), three articles were published in 2015, while only one article was found in 2016 and 2019. Korea has been the country with the highest production with six articles, followed by the United States and Hong Kong with three publications, China had two studies and other countries such as Germany, India, Iran, South Africa and Taiwan each had one publication.

Analyzing the sample used in the different studies, there is a total of 16,025 subjects with an average sample of 843.42 subjects per study, with the Ndayizigamiye; Kante, and Shingwenyana study [54] having the smallest sample (*n* = 139) and Wei, Vinnikova, Lu and Xu study [55] having the largest sample with a total of 8840 subjects. Approximately a half of the studies (*n* = 8) used university students as a sample, followed by studies that considered users of sports applications (*n* = 4) and other studies took as their general population [54–56], a population of sports consumers [45], employees of a sports organization [57] and members of a fitness community [44,58]. Most studies had a higher proportion of females than males (*n* = 9), followed by studies that had parity in the sample (*n* = 5), four studies had a higher proportion of males while one study did not indicate the gender distribution of the sample [34]. Finally, all studies except Ha et al. [42] and Yoo et al. [53] reported some data on the age of the subjects. About half of the studies (*n* = 10) expressed age using a range, five studies showed age using mean (M = 24.58 years) and two studies did not specify the age [55,59]. The analysis indicated that mainly the study population are young subjects between 20 and 29 years old and all are over 18 years old except Lee, Kim and Wang [45] which also included 17-year-old subjects. Li, Liu, Ma and Zhang [46] sampled subjects over 25 years of age, while Huang and Ren [60] and Mohammadi and Isanejad [57] were at least 30 years old.

Table 2. Descriptive data of the analysis of the selected studies.

Authors	Country	Sample	App Type	Theory	Data Analysis Methods	Measure Outcomes
Beldad & Hegner [43]	Germany	German's app user ($n = 476$) Male: 50.0% Female: 50.0% Age: 26.7 ± 5.0	Sport information	TAM	Content Analysis	Trust in the Fitness App Developer; Descriptive Social Norm; Injunctive Social Norm; Perceived Ease of Use; Perceived Usefulness; Intention to Continue Using a Fitness App
Byun, Chiu, & Bae [45]	Korea	Korean consumers ($n = 261$) Male:4 9.1%; Female: 50.9% Age: 20–29 (29.9%); 30–39 (34.9%); 40+ (5.2%)	Sport Brand	TAM	Content Analysis	Perceived Enjoyment; Perceived Ease of Use; Perceived Usefulness; Intention to use; Actual usage
Chen & Lin [44]	Taiwan	Fitness Community ($n = 994$) Age: 20− (10.06%); 20–29 (56.14%); 30–39 (1.83%); 40–49 (8.65%); 50–59 (3.32%)	Diet/Fitness	TRAM	Content Analysis	Health Consciousness; Optimism; Innovativeness; Discomfort; Insecurity; Perceived Ease of Use; Perceived Usefulness; Attitude toward Using App; Intention to download app
Chiu & Cho [61]	Hong Kong	Korean university students ($n = 204$) Male: 51.9%; Female: 48.1% Age: 19–25 (71.8%); 26–30 (10.7%); 30+ (17.5%)	Health/Fitness	TRAM	Descriptive Content Analysis	Optimism; Innovativeness; Insecurity; Discomfort; Perceived Usefulness; Perceived Ease of Use; Perceived Enjoyment; Intention to use
Chiu, Cho, & Chi [56]	Hong Kong	Chinese population ($n = 342$) Male: 45.6%; Female: 54.4% Age: 20− (1.2%); 21–25 (14.9%); 26–30 (35.4%); 31–35 (29.8%); 36–40 (11.1%); 40+ (7.6%)	Health/Fitness	ECM	Descriptive Correlational Content Analysis	Investment size; Quality of alternative; Commitment; Confirmation of expectations; Satisfaction; Perceived Usefulness; Continuance Intention
Cho, Lee, Kim, & Park [59]	Korea	University students ($n = 294$) Male: 33.0% Female: 67.0% Age: 23.2	Diet/Fitness	TAM	Correlational Content Analysis	Appearance Evaluation; Fitness Evaluation; Appearance Orientation; Fitness Orientation; Perceived Usefulness; Intention to Use App
Cho, Lee, & Quinlan [51]	Korea	University students ($n = 508$) Male: 34.6%; Female: 65.4% Age: 21.5	Diet/Fitness	TAM	Descriptive Content Analysis	Subjective Norms; Entertainment; Recordability; Networkability; Perceived Ease of Use; Perceived Usefulness; Behavioral Intention to Use
Cho & Kim [52]	Korea	University students ($n = 277$) Male: 34.3%; Female: 65.7% Age: 22.5	Diet/Fitness	TAM	Content Analysis	Smartphone Use Efficacy; Internet Information Use Efficacy; Internet Information Credibility; Perceived Ease of Use; Perceived Usefulness; Behavioral Intention
Dhiman, Arora, Dogra, & Gupta [58]	India	Indian fitness lefts users ($n = 324$) Male: 54.0%; Female: 46.0% Age: 20− (16.0%); 20–40 (80.0%); 40+ (4.0%)	Fitness	UTAUT2	Descriptive Correlational Content Analysis	Performance Expectancy; Effort Expectancy; Self Efficacy; Social Influence; Facilitating Conditions; Hedonic Motivation; Price Value; Personal Innovativeness; Habit; Behavioral Intention

Table 2. *Cont.*

Authors	Country	Sample	App Type	Theory	Data Analysis Methods	Measure Outcomes
Ha, Kang, & Kim [42]	Korea	University students ($n = 226$) Male: 50.8%; Female: 49.2% Age: 25.3	Sport Information	TAM	Descriptive Content Analysis	Sport Involvement; Sport Commitment; Social Influence; Personal Attachment; Media Multitasking; Perceived Enjoyment; Perceived Ease of Use; Perceived Usefulness; Usage Intention
Huang & Ren [60]	Hong Kong	Chinese app users ($n = 449$) Male: 43.0%; Female: 57.0% Age: 31.85 ± 6.9	Fitness	TAM	Regression	Instruction Provision; Self-Monitoring; Self-Regulation; Goal Attainment; Exercise Self Efficacy; Perceived Usefulness; Perceived Ease of Use; Perceived Enjoyment; Continuance Intention
Kim, Kim, & Rogol [1]	United States	App users ($n = 233$) Male: 68.2% Female: 31.8% Age: 18–24 (46.8%); 25–34 (31.8%); 35–44 (13.7%); 45–54 (7.3%); 55+ (0.4%)	Sport Team	TAM	Descriptive Content Analysis	Innovativeness; Perceived Ease of Use; Perceived Enjoyment; Perceived Trust; Perceived Usefulness; Intention; Sport Apps Use
Lee, Kim, & Wang [62]	United States	College students ($n = 267$) Male: 32.2% Female: 67.8% Age: 17–20 (48.3%); 21–25 (40.8%); 26–29 (8.2%); 29+ (2.6%)	Sport App	UTAUT	Correlational Content Analysis	Entertainment Motivation; Social Utility Motivation; Performance Expectancy; Effort Expectancy; Social Influence; Intention to Mobile Sports Apps Use
Li, Liu, Ma, & Zhang [63]	China	Sport App users ($n = 211$) Male: 45.02% Female: 54.98% Age: 25–30 (41.71%); 30–35 (47.87%) 35+ (10.43%)	Social Fitness-tracking	UTAUT2	Content Analysis	Activity Amount Ranking; Activity Frequency Ranking; Confirmation; Upward Comparison Tendency; Continuous Intention
Mohammadi & Isanejad [57]	Irán	Employers Sport Organization ($n = 332$) Male: 37.3% Female: 62.7% Age: 30− (10.0%); 31–40 (44%); 41–50 (38%); 50+ (8%)	IT information	TAM	Descriptive Correlational Content Analysis	Technology Anxiety; Technology Self-efficacy; Perceived Enjoyment; Perceived Ease of Use; Perceived Usefulness; User Satisfaction; Attitude; Intention to use
Ndayizigamiye; Kante, & Shingwenyana [54]	South Africa	South African population ($n = 139$) Male: 41.5%; Female: 58.5% Age: 18–23 (57.15%); 24–29 (29.9%); 30–35 (7.5%)	mHealth	UTAUT	Correlational Content Analysis	Awareness, Effort Expectancy; Facilitating Conditions; Performance Expectancy; Social Influence; Behavioral Intention

Table 2. *Cont.*

Authors	Country	Sample	App Type	Theory	Data Analysis Methods	Measure Outcomes
Wei, Vinnikova, Lu, & Xu [55]	China	Chinese population (*n* = 8840) Male: 4.78%; Female: 74.55%	Diet/Fitness	UTAUT	Descriptive Correlational Content Analysis	Perceived Benefits; Perceived Barriers; Perceived Threats; Self-Efficacy; Risk Perception; Performance Expectancy; Weight Loss Intention; Behavioral Intention; Use Behavior
Yoo, Ko, & Yeo [53]	Korea	University students (*n* = 1331) Male: 65.9%; Female: 34.1%	Sport Content	TAM	Content Analysis	Perceived Trust; Perceived Usefulness; Attitude; Using intention
Yuan, Ma, Khantawala & Peng [30]	United States	University students (*n* = 317) Male: 21.1% Female: 78.9% Age: 21	Diet/Fitness	UTAUT2	Content Analysis	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Price value; Hedonic motivation; Habit; Intention to use

ECM: Expectation-Confirmation Model.

Regarding the type of App evaluated, six studies evaluated the intention to use diet and fitness applications [30,44,51,52,55,59], another five studies evaluated sports information Apps [42,43,53,57,62], two studies measured the intention of fans to use the sports team app [1,45], health and fitness app [56,61], or fitness [58,60] and one study evaluated a social fitness-tracking app [63] and mHealth related to promote physical activity [54]. The most widely used theory for the design and use of the mobile sports app intent of use assessment instrument was TAM ($n = 10$). Chen and Lin [44] and Chiu and Cho [61] used a variant of the TAM, Theory of Readiness and Acceptance Model (TRAM), three studies used UTAUT [54,55,62] and UTAUT2 [30,58,63], and an article with the Expectation-Confirmation Model (ECM) [56]. The most common method of analysis used was a content analysis by structural equations using the AMOS statistical package ($n = 9$) and the rest of the Partial Least Square studies. Seven studies also performed a correlation analysis of the data [54–59,62], and eight studies performed descriptive analysis in addition to content analysis [1,42,51,55–58,61].

The variables used by the different studies have been very varied, where the intention to use App has been found in all studies as a common factor. Considering that this systematic review study focused on studies based on TAM as the most commonly used theory in sports marketing studies, it implies that there are other common variables among most studies such as perception of usefulness ($n = 13$) and perception of ease of use ($n = 10$). Some studies have included other different perceptions by relating them to the previous ones and the intention to use, such as the perception of enjoyment [1,42,45,60,61] or the perception of trust [1,53]. The remaining variables used have been very diverse, with each study using different variables that can be seen in Table 2. However, the variable of social influence has received greater interest from researchers and has been considered in five studies [30,42,54,58,62].

Analyzing the quantitative data on the relationships between the most common variables associated with TAM (Table 3), the six studies that had a different theory such as UTAUT [54,55,62] or UTATUT2 [30,58,63] were excluded; however, the study that used ECM was included because there was a relationship between variables "perception usefulness" and "intention to use" [56]. The sample was very heterogeneous in terms of the results of the existing relationships and sample size in each study. In order to homogenize these results, the effect size of each correlation was calculated. A total of seven relationships were identified between the different variables associated with TAM such as perception of ease of use (PEOU), perception of utility (PU), perception of enjoyment (PE), perception of trust (PT), intention to use (ITU) and actual usage (AU).

Table 3. Quantitative data on the relationships between "Theory Acceptance Model" (TAM) variables in the selected studies.

Authors	PE-PEOU	PEOU-PU	PE-ITU	PEOU-ITU	PU-ITU	PT-ITU	ITU-AU
	R (CI 95%)	R (CI 95%)	R (CI 95%)	R (CI 95%)	R (CI 95%)	R (CI 95%)	R (CI 95%)
Beldad & Hegner [43]	-	0.180 *** (0.092; 0.266)	-	0.440 *** (0.365; 0.510)	0.330 *** (0.246; 0.408)	-	-
Byun, Chiu, & Bae [45]	0.584 *** (0.498–0.659)	0.583 *** (0.497; 0.658)	0.454 *** (0.352; 0.545)	0.157 * (0.036; 0.273)	0.318 *** (0.205; 0.423)	-	0.306 *** (0.19; 0.41)
Chen & Lin [44]	-	0.650 *** (0.613; 0.685)	-	0.310 *** (0.253; 0.365)	0.510 *** (0.463; 0.555)	-	0.530 *** (0.484; 0.573)
	-	0.660 *** (0.623; 0.694)	-	0.300 *** (0.24; 0.36)	0.500 *** (0.452; 0.545)	-	0.520 *** (0.473; 0.546)
Chiu & Cho [61]	0.453 *** (0.337; 0.556)	0.222 *** (0.087; 0.349)	0.293 *** (0.162; 0.414)	0.213 ** (0.078; 0.340)	0.373 *** (0.248; 0.486)	-	-
Chiu, Cho, & Chi [56]	-	-	-	-	0.299 ** (0.199; 0.392)	-	-
Cho, Lee, Kim, & Park [59]	-	-	-	-	0.750 *** (0.70; 0.80)	-	-
Cho, Lee, & Quinlan [51]	-	0.229 *** (0.145; 0.310)	-	0.001 (−0.086; 0.088)	0.431 *** (0.357; 0.500)	-	-
Cho & Kim [52]	-	0.580 *** (0.496; 0.653)	-	−0.130 (−0.244; −0.012)	0.800 *** (0.753; 0.839)	-	-
Ha, Kang, & Kim [42]	0.770 * (0.711–0.818)	0.870 * (0.834; 0.899)	−0.08 (−0.51; 0.208)	0.350 * (0.230; 0.460)	0.090 (−0.041; 0.218)	-	-
Huan & Ren [60]	-	-	0.233 *** (0.144; 0.319)	0.270 *** (0.182; 0.354)	0.404 *** (0.324; 0.479)	-	-
Kim, Kim, & Rogol [1]	-	-	0.313 ** (0.192; 0.424)	0.163 (0.035; 0.286)	0.628 *** (0.543; 0.700)	0.387 * (0.272; 0.491)	0.787 *** (0.733; 0.831)
			0.331 *** (0.212; 0.440)	0.204 (0.078; 0.324)	0.728 *** (0.661; 0.783)	0.475 * (0.369; 0.569)	0.806 *** (0.756; 0.847)
			0.287 ** (0.165; 0.400)	0.149 (0.021; 0.272)	0.580 *** (0.489; 0.660)	0.359 * (0.241; 0.466)	0.808 *** (0.758; 0.848)
Mohammadi & Isanejad [57]	0.370 ** (0.273–0.459)	0.386 ** (0.290; 0.473)	-	0.173 ** (0.067; 0.283)	0.192 ** (0.086; 0.293)	-	-
Yoo, Ko, & Yeo [53]	-	-	-	-	0.454 *** (0.410; 0.496)	0.403 *** (0.357; 0.447)	0.963 *** (0.959; 0.967)

Table 3. *Cont.*

Authors	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)	Fisher's Z (CI 95%)
Beldad & Hegner [43]	-	0.18 (0.09; 0.27)	-	0.47 (0.38; 0.56)	0.34 (0.25; 0.43)	-	-
Byun, Chiu, & Bae [45]	0.67 (0.55; 0.79)	0.67 (0.55; 0.79)	0.49 (0.37; 0.61)	0.16 (0.04; 0.28)	0.33 (0.21; 0.45)	-	0.32 (0.19; 0.44)
Chen & Lin [44]	-	0.78 (0.71; 0.84)	-	0.32 (0.26; 0.38)	0.56 (0.50; 0.63)	-	0.59 (0.53; 0.65)
	-	0.79 (0.73; 0.86)	-	0.31 (0.25; 0.37)	0.55 (0.49; 0.61)	-	0.58 (0.51; 0.64)
Chiu & Cho [61]	0.49 (0.35; 0.63)	0.23 (0.09; 0.36)	0.30 (0.16; 0.44)	0.22 (0.08; 0.35)	0.39 (0.25; 0.53)	-	-
Chiu, Cho, & Chi [56]	-	-	-	-	0.31 (0.20; 0.41)	-	-
Cho, Lee, Kim, & Park [59]	-	-	-	-	0.97 (0.86; 1.09)	-	-
Cho, Lee, & Quinlan [51]	-	0.23 (0.15; 0.32)	-	0.001 (−0.09; 0.09)	0.46 (0.37; 0.55)	-	-
Cho & Kim [52]	-	0.66 (0.54; 0.78)	-	−0.13 (−0.25; −0.01)	1.10 (0.98; 1.21)	-	-
Ha, Kang, & Kim [42]	1.02 (0.89; 1.15)	1.33 (1.20; 1.46)	0.08 (−0.05; 0.21)	0.37 (0.23; 0.50)	0.09 (−0.04; 0.22)	-	-
Huan & Ren [60]	-	-	0.24 (0.14; 0.33)	0.28 (0.18; 0.37)	0.43 (0.34; 0.52)	-	-
	-	-	0.32 (0.19; 0.45)	0.16 (0.04; 0.30)	0.74 (0.61; 0.87)	0.41 (0.28; 0.54)	1.06 (0.93; 1.19)
Kim, Kim, & Rogol [1]	-	-	0.34 (0.214; 0.47)	0.21 (0.08; 0.34)	0.92 (0.80; 1.05)	0.52 (0.39; 0.65)	1.12 (0.99; 1.24)
			0.30 (0.16; 0.42)	0.15 (0.02; 0.28)	0.66 (0.53; 0.79)	0.38 (0.25; 0.51)	1.12 (0.99; 1.25)
Mohammadi & Isanejad [57]	0.39 (0.28; 0.50)	0.41 (0.30; 0.51)	-	0.17 (0.07; 0.28)	0.19 (0.09; 0.30)	-	-
Yoo, Ko, & Yeo [53]	-	-	-	-	0.49 (0.44; 0.54)	0.43 (0.37; 0.48)	1.99 (1.93; 2.04)

Note: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$; PE: Perceived Enjoyment; PEOU: Perceived Ease of Use; PT: Perceived Trust; PU: Perceived Usefulness; ITU: Intention to Use; AU: Actual Usage.

The first relationship between the variables PE and PEOU was found in four different studies showing results of different degree of relationship, although all significant. In the study by Mohammadi and Isanejad [57], the effect size was found to indicate a low-medium influence of PE on PEOU [Fisher's Z = 0.39 (0.2; 0.50)], Chiu and Cho [61] found a medium influence [Fisher's Z = 0.49 (0.35; 0.63)], while Byun et al. [45] found a medium-high influence of PE on PEOU [Fisher's Z = 0.67 (0.55; 0.79)] and a very high influence of enjoyment in students on ease of use [Fisher's Z = 1.02 (0.89; 1.15)]. Another relationship of perceptions and the most studied is between PEOU and PU. Although all the existing relationships were significant, they had different levels of relationship: for example, three studies had a low influence of PEOU on PU with values lower than 0.30 [43,51,61], while Mohammadi and Isanejad [57] found that PEOU had an influence on lower-middle on PU [Fisher's Z = 0.41 (0.30; 0.54)]. Other studies found a high or very high influence between these two variables [Fisher's Z ≥ 0.66]. In the selected studies, no other studies were found where the different dimensions of TAM were interrelated.

The relationship of the different variables on the ITU is explained below. Firstly, four studies found an influence of PE on ITU where PE had a low influence [60,61], and moderate and significant influence on ITU in the different models evaluated with an effect size range between 0.30 and 0.49 [1,45]. In contrast, Ha et al. [42] did not find that PE had an influence on ITU [Fisher's Z = 0.08 (−0.05; 0.21)]. One of the most studied relationships is the PEOU with ITU, being tested in ten studies with contradictory results. Seven studies found a significant relationship, however, except Beldad and Hegner [43] which had a moderate influence [Fisher's Z = 0.47 (0.38, 0.56)] and Chen and Lin [44] in their study evaluated two models with moderate-low influences [Fisher's Z1 = 0.31 (0.25, 0.37); Fisher's Z2 = 0.32 (0.26, 0.38)]. The rest had a low influence [45,57,60,61] or nonsignificant influence [1,51,52].

The relationship between PU and ITU was evaluated in all of the studies analyzed finding different levels of relationship in the studies. Most studies (*n* = 9) found a moderate and significant influence between both variables with a range of Fisher's Z = 0.31–0.66 [1,43–45,51,53,56,60,61]. Some studies found a significant high to very high ratio with a large influence of PU on ITU based on effect size values above 0.70 [52,59] and in two of the three models proposed by Kim et al. [1]. Mohammadi and Isanejad [57] found a low influence on sports organization employees [Fisher's Z = 0.19 (0.09, 0.30) and Ha et al. [42] found no PU influence on ITU in university students on sports information Apps.

In turn, two studies evaluated the relationship between PU and ITU observing the existence of a moderate and significant influence between both variables in the three models proposed by Kim et al. [1] [Fisher's Z = 0.38–0.52] and Yoo et al. [53] [Fisher's Z = 0.43 (0.37; 0.48)]. Finally, some studies evaluated the relationship between ITU and AU found relationships where ITU had a moderate-low influence [45] [Fisher's Z = 0.32 (0.19, 0.44)], while other studies found a moderate influence [44] and a very high influence [1,53].

3.3. Summary of Factors Relationship by Age

In order to carry out the analysis of the different relationships between the factors analyzed (Table 3) based on age, an analysis was made of the data shown by the different studies. The studies have been classified into three groups considering the mean age or the age range with the highest percentage. One group was established with six studies that had a higher proportion of subjects under 25 years [1,51–53,59,61], a second group formed by three studies with the age of the subjects between 25 and 30 years [42,43,56] and finally, a third group had a higher proportion of subjects over 30 years [45,57,60]. Chen and Lin's study [44] was not classified as it indicated that their sample was mostly composed of subjects between 20 and 30 years of age.

The relationship between PE and PEOU showed that the study of group 25–30 years was very high and significant [42], compared to group under 25 and group over 30, which had very similar moderate and significant relationships with an effect size range between 0.39 and 0.67 [45,57,61]. The relationship between PEOU and PU found that the studies with the lowest influence [43] and the highest influence [42] belonged to the group 25–30. The studies of the group over 30 had generally more influencing than the group under 25 who had the most studies with a low influence. However,

the study by Chen and Lin [44] reported that in their two models the relationship between PEOU and PU was high above 0.70, and significant. Concerning the PE relationship on ITU, the group over 30 had a moderate and significant overall influence [45,60], being higher than the group under 25 [1,61], while the study of the group 25–30 found no relationship between these two factors [42].

The group 25–30 revealed a significant influence of moderate level on the relationship between PEOU and ITU with effect sizes higher than 0.37 [42,43], and the studies of the group over 30 found the existence of significant relationships with a low influence [45,57,60]. On the other hand, most studies of the group under 25 did not show the existence of significant differences between these factors [1,51,52], except the study of Chiu and Cho [62] that had a low and significant influence. Chen and Lin [44] obtained moderate-low relations in their two models in the population between 20 and 30 years old. The most studied relationship in all studies was between PU and ITU, with a great variability in the results according to the different studies in each age group. Therefore, the larger influence has been found in the studies of the group under 25, with studies that had moderate [51,53,60], high [1,59] and very high [52] relationships, while one study of the group 25–30 observed a high influence [59] and two studies showed moderate influences [43,56]. However, the group 25–30 had one study in which no relationship was found between PU and ITU [42]. The group over 30 had all significant relationships with a variable low level [57] to moderate level [45,60]. In addition, Chen and Lin [44] reported a moderate influence of PU on UTI in their two proposed models. Finally, the relationship between ITU and AU has not been studied much, and no studies were found that took it into account in the group 25–30. Regarding the other two groups, the group under 25 obtained that the youngest ones presented a great influence between ITU and AU giving them significant and high relationships with an effect size above one point [1,53]. In the study of group over 30, a moderate-low relationship was found [45], and Chen and Lin had moderate-significant relationships [44].

4. Discussion

The continuous technological advances have awakened the interest of marketing researchers in the intention to use Apps, especially in the field of sports. Walter [64] explained the existence of a trend towards increased interest by fitness consumers in using Apps for exercise control. Therefore, the aim of this study was to conduct a systematic review of the literature on consumers' intention to use Apps related to fitness and physical activity. The result of the systematic search has been the existence of a remarkable interest in the subject, as the studies were found in the last four years; however, studies focused on sport Apps are still limited ($n = 19$) with very heterogeneous methodologies.

In the context of marketing, the existence of different theories to explain sports consumer behavior has been observed, with TAM being the most applied in the different studies found ($n = 10$) or some version derived from it such as TRAM [44,61], UTAUT in the study carried out by Lee et al. [62], Ndayizigamiye et al. [54] and Wei et al. [55], or UTAUT2 used by Dhiman et al. [58], Li et al. [46] and Yuan et al. [20]. One study used a different model, ECM, which was not derived from TAM [56]. Although most publications use the same base, no similar studies have been found that can be compared since the different authors have used the two basic constructs (PEOU and PU) of the theory proposed by Davis [24] and have incorporated other variables such as PE [1,42,45,57,60,61] or PT [1,53]. In addition, they have been relating these variables to the Apps ITU and AU [1,44,45,53] or to various other variables outside of TAM such as social influence [30,42,54,58,62], Health Consciousness [44], social norms [43] or sports context as sport involvement or sport commitment [42].

Most of the studies analyzed have tried to predict the influence of PEOU and PU on ITU, finding significant relationships between both constructs [42–45,51,52,57,61]. These relationships have been evaluated previously in the context of sport websites as a technological tool prior to the appearance of the Apps [31,38,39,65]. However, the findings found are different from those proposed by different studies that concluded with a greater influence of PU on PEOU in ITU [24,38,49,65–70] or where PEOU had no significant influence on ITU [1,51,52] or in the case of Ha et al. [42] where they found that PU

had no influence on ITU as opposed to PEOU. In particular, it should be noted that Davis [24] argued that PEOU is a secondary determinant construct of ITU in the perception of technology.

Furthermore, the use of other added beliefs such as PE or PT can also play a key role within the TAM, as PE not only has influence on PEOU [42,45,57,61] but also on ITU [1,45,60,61]. Ha et al. [42] found no influence of PE on ITU, but the authors felt that while it was not related to ITU, it was related to PEOU, allowing sports consumers to undermine the difficulty of using the technology [71]. These results highlight the hedonic motives of sports consumers who often overlook entertainment [26,65,71] and may make the App more interesting to sports fans if they find it fun and easy to use. On the other hand, PT has been found to be an important and influential factor on ITU [1,38,39,53,69]; this importance may be motivated by the fact that if a sports fan finds the information they receive useful and reliable they will show a greater interest in continuing to use the technology.

For example, in a study in Germany on the use of fitness Apps, it showed that the reasons for using them were to have the achievement of fitness goals and the enjoyment of being able to share the results obtained with their contacts [72], so gamification could have a direct relationship with their use [73]. Another aspect to take into account for consumers is that if they find the App tedious and requiring tedious procedures initially, it negatively affects their intention to make use of the App when considering them complex [74]. On the other hand, Wang Egelandsdal, Amdam, Almli and Oostindjer [75] express that time and effort may discourage users from using health Apps, thus arguing why PEOU can explain with more influence the ITU new technologies than PEU. A qualitative study by Tang, Abraham, Stamp and Greaves [76] revealed that the appearance and structure of a weight loss app's interface could significantly influence the decision to use such technology. Sports providers should conduct better market research to better understand what fans want or expect in order to meet their expectations [77].

Analyzing the results of the relationships according to the age of the subjects in the sample, three different groups were established according to the average age of the sample or the age range with the highest percentage of representativeness. The first group consisted of studies with subjects under 25 years old [1,51–53,59,61], the second group consisted of participants aged between 25 and 30 years [42,43,56], a third group consisted of people over 30 years old [45,57,60] and one study was not grouped because the age of the sample ranged from 20 to 29 years [44]. Considering the different age groups and the relationships between the different factors, the results have shown that the group under 25 in the PU-ITU and ITU-AU relationships, this is, the studies with the larger young population, showed higher relationships of influence on the usefulness of the application for its use [1,51–53,59,60]. Young people were more likely to use fitness or sport Apps when they found them more functional, which meant that this intention had a great influence on the actual use of the app [1,53]. The studies in the group 25–30 and group over 30 found similar moderate relationships between PU-ITU, except for two studies in the group 25–30, one study observed a high influence between PU-ITU [59], and the study did not find PU to significantly influence UTIs [42].

On the other hand, the group 25–30 highlighted among the other two groups the relationships that have evaluated the PEOU factor, emphasizing the influence of this factor on ITU [42,43], while in the PEOU-PU relationship, the two studies of the group 25–30 that analyzed this relationship were the ones that had the greatest and least influence compared to the studies of the other groups [42,43]. The subjects in this intermediate group considered more the ease and intuition of the app to be able to perform it than the younger or older subjects. The group over 30 also found a moderate to high influence on the PEOU-ITU relationship [45,57]. However, the older group of studies were the ones that stood out in the PE influence on UTIs [45,60]; that is, an app that is fun will be more likely to be used. Finally, PE was shown to have a moderate influence on PEOU in the group under 25 [61] and group over 30 [45,57] and high influence in the group 25–30 [42].

Limitations and Future Research

Among the limitations of this review study could be started with the reduction of studies that are based on TAM and not the other existing theories or models. Likewise, a document search in the grey literature was not performed since the researchers marked a criterion that the studies should be collected in the different databases analyzed. Another aspect that could have conditioned the study was the focus only on studies that evaluated only fitness and physical activity Apps, discarding the studies that could evaluate the use of wearables or sports webs that would allow a broader analysis of existing studies on the intention to use in the sports context. Similarly, the years of research for the study could have been limited to the dates since the appearance of the Smartphone and the Apps, resulting in a large number of initial results that were not limited in time.

In addition, another of the limitations found is the lack of a common questionnaire that has been replicated in different studies and allows a better comparison of the different populations. This fact may be due to the fact that this line of research is very recent and very few studies have appeared that could lead to its replication and comparison of studies. In addition, all the studies choose the sample for convenience, whether the groups of university students or sports groups are easily accessible. The use of convenience sampling denotes a lack of application of more appropriate sampling that would allow the generalization of results to a larger universe. Some studies did refer to this limitation [44,78]. The age of the participants has been a widely reported limitation in the different studies [1,51,52,61,78] where the sample was mainly composed of young people born into the new digital society and whose beliefs may be very different from those of middle-aged adults who have not been raised in a digital society and who tend to have greater difficulties in starting to use the new technologies. Only three studies looked at a sample over 30 years old [45,57,60], while in the literature there is a study that evaluated the use of websites by people over 50 [79].

These differences between age groups and therefore with digital gaps must also be approached from a sociodemographic point of view and with very different contexts. For example, Cho et al. [51] carried out a comparative study between the Korean and American populations, highlighting the existence of a limitation in this type of study due to the oversocialization of the individual characteristics of consumers and their contexts. Thus, some authors indicate that an individual's socioeconomic status and educational level affect their use of new technologies and Apps, since individuals with a higher level of education may have better digital skills [51]. In fact, they may have greater access to a larger number of technological devices, since not only Smartphones should be considered but also other devices such as tablets, laptops or even wearables [42]. This factor is important to take into account as currently, there are other technological devices that could use sports Apps (i.e., tablets, i-watch, etc.).

Similarly, the operating system could have an influence as not all Apps are available on the current large operating systems (Android and IOS). In addition, there are a multitude of different Apps that perform the same functions and many studies question the intention to use without determining what type of Apps the consumer uses. This fact could lead to a self-selection bias when filling out the questionnaire by the consumer considering the App that people use and not one common to the entire population [44].

With regard to other methodological aspects of the studies, it should be noted that all the studies found have had a cross-sectional approach, and no longitudinal study has been found to evaluate the evolution of the subject and his or her real intention to continue using said App. Chen and Lin [34] point out that there may be a discrepancy between the ITU of the App on the part of the consumer and the actual use that they make of this App afterwards. In general, this has been a relationship that some studies have considered [1,35,43]; however, as these are cross-sectional studies, it has not been possible to verify the change that they have had with respect to a lesser or greater use of the App. Likewise, not all studies have included other variables associated with TAM such as PE or PT which allow us to verify their influence on ITU in different groups and contexts.

Finally, this review has mainly focused on the search for quantitative studies, finding several qualitative studies but only two studies were found that used mixed methods to evaluate the ITU and

to be able to check what the user expresses in the questionnaire with the actual opinion about that App [75,80].

Future lines of research on the intention to use sports Apps or any other device should consider the inclusion of more variables of TAM in their model, as well as other variables specific to the Smartphone (social influence, attachment to the device, etc.), the sports context (motivation, commitment, participation) or variables traditionally linked to sports marketing such as satisfaction [44]. Therefore, common measuring instruments should be standardized to allow their application in different contexts. Similarly, the different age generations should be taken into account when evaluating and sampling in a population that includes consumers of different age ranges.

It would also be interesting to sample populations that do not refer to a single sport or discipline but rather have a variety of Apps from different sports or sports teams. Future work should also be carried out in a longitudinal way, being able to check whether the intention to use predisposed by the subject ends up being the real use of the application or not. Finally, it is interesting to contemplate studies that cover different social groups with cultural diversity analyzing not only the intention to use in the context itself but also in the individual characteristics of the consumer with different status and educational levels to evaluate the digital gap.

5. Conclusions

This systematic review responded to the need for a critical evaluation of existing research on the intentions of using sports Apps as this is an emerging field of research. The limited number of academic studies together with the deficiencies in some methodologies as can be seen in the risk analysis of research bias and the evidence found, has not allowed a more critical evaluation. These findings highlight the need for more rigorous and systematic research by researchers in the field, putting factors in common that allow a better evaluation of the context of the use of new technologies in the sports environment. At the same time, these findings have allowed the research team to identify a range of recommendations for sports organizations and researchers, which will help them to address future studies, and thus allow for a better growth and development of the evaluation of the intention to use Apps in sport.

Practical Implications

Sports organizations, sports marketing experts and new technology developers should make use of the considerations made in this study when developing or upgrading a sports App either for general sports information, a sports brand or exercise or health monitoring. Sports Apps have a great potential for the promotion and sponsorship of different products due to the potential use they have by consumers through advertising in these technologies. Suppliers of sports brands (retail, teams, etc.) should carry out an in-depth analysis of the fans by means of one of the tools evaluated that allow them to design the Apps according to the user's expectations and to know what type of information or applicability they expect from it.

Another practical implication that is obtained is the possibility for sports organizations to develop Apps that have a gamification part that links the fan to consume the sports brand while he can enjoy certain benefits for using the organization's App. They should also look for ways to engage the consumer with the App during the competition, i.e., generate exclusive content that can only be enjoyed by fans who have attended the live game, causing greater interest in the use of the App. Finally, to improve the quality of the Apps on Smartphones or other devices, industry and marketing professionals should examine all communication channels to ensure convenient access to the different content and services available.

In addition, the period of confinement caused by the COVID-19 pandemic, which has forced millions of people to stay at home, highlights the importance of this study to know the current situation on the topic of the intention to use fitness Apps by the population, especially for sports specialists and managers to know how to fit into the periods of new normality in which social distancing is forced. Although they have been in development for a long time, during the period of confinement there has been an increase in the offer of digital channels that help the guided practice of physical activity through the use of safe, simple and easy to implement programs and applications that cover activities related to cross-fit, yoga or dance activities for the general population or for the improvement of physical and mental well-being in older adults [18,81,82]. For experts in sports management or trainers, platforms such as Youtube or Zoom allow for individualized methods of physical exercise and real-time contact with the monitor, which allows for feedback to users regardless of where they are located [83]. Finally, Ammar et al. [84] suggest that future physical activity intervention to stay active during times of pandemic may be based on information and communication technologies, such as fitness Apps. Therefore, it is necessary to focus on a more in-depth study on the intention of the population to use these types of applications to promote active and healthy lifestyles.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Assessment methodological quality (part 1).

Item N	Section/Topic and Checklist Item	Beldad & Hegner [43]	Byun et al. [45]	Chen & Lin [44]	Chiu & Cho [62]	Chiu et al. [56]	Cho et al. [59]	Cho et al. [51]	Cho & Kim [52]	Dhiman et al. [58]	Ha et al. [42]
	Title and Abstract										
1a	Identification of the type of study in the title	1	1	1	1	1	1	1	1	1	1
1b	Structured summary of objective, methods, results and conclusions	0	1	1	1	1	1	1	1	1	0
	Introduction										
	Background and Objectives										
2a	Scientific background and explanation of rationale	1	1	1	1	1	1	1	1	1	1
2b	Specific objectives or hypotheses	1	1	1	1	1	1	1	1	1	1
	Methods										
	Participants										
3a	Eligibility criteria for participants	1	1	0	0	0	0	1	0	0	1
3b	Settings and locations where the data were collected	0	0	0	1	1	1	1	0	1	1
3c	A table showing baseline demographic characteristics	0	1	1	1	1	0	1	0	1	0
	Sample Size										
4a	The sample size has been determined	0	0	0	0	0	0	0	0	0	0
4b	When applicable, explanation of how sample size was determined	0	0	0	0	0	0	0	0	0	0
	Procedure										
5	The procedure has sufficient details to allow replication, including how and when they were actually administered	0	1	0	0	1	1	1	1	1	0
	Instrument or Tools										
6a	Completely defined prespecified primary and secondary outcome measures, including how and when they were assessed	1	1	1	1	1	1	1	1	1	1
6b	Use of validity and reliability tools.	1	1	1	1	1	1	1	1	1	1
	Implementation										
7	Who made each part of study	0	0	0	0	0	0	0	0	0	0
	Statistical Methods										
8a	Statistical methods used to analyze the results	1	1	1	1	1	1	1	1	1	1
8b	Use of Methods for additional analyses to objective of study	0	0	1	1	0	1	1	0	0	0
	Results										
	Outcomes and Estimation										
9	A table or figure showing outputs of analysis more relevant of study	1	1	1	1	1	1	1	1	1	1

Table A1. *Cont.*

Item N	Section/Topic and Checklist Item	Beldad & Hegner [43]	Byun et al. [45]	Chen & Lin [44]	Chiu & Cho [62]	Chiu et al. [56]	Cho et al. [59]	Cho et al. [51]	Cho & Kim [52]	Dhiman et al. [58]	Ha et al. [42]
	Discussion										
	Interpretation										
10	Interpretation consistent with results, balancing benefits and harms and considering other relevant evidence	1	1	1	1	1	0	1	0	1	1
	Limitations										
11	Study limitations, addressing sources of potential bias, imprecisions, etc.	1	1	1	1	1	1	1	0	1	1
	Practical Implication										
12	Main applicability to results of study	1	1	1	1	1	1	1	0	1	1
	Other Information										
	Funding										
13	Sources of funding and other support, role of funders	1	1	0	0	0	1	1	0	0	0
	TOTAL	12	15	13	14	14	14	17	9	14	12

Table A2. Assessment methodological quality (part 2).

Item N	Section/Topic and Checklist Item	Huang & Ren [60]	Kim et al. [1]	Lee et al. [61]	Li et al. [63]	Mohammadi & Isanejad [57]	Ndayizigamiye et al. [54]	Wei et al. [55]	Yoo et al. [53]	Yuan et al. [30]
	Title and Abstract									
1a	Identification of the type of study in the title	1	1	1	1	1	1	1	1	1
1b	Structured summary of objective, methods, results and conclusions	1	1	1	1	1	1	1	1	1
	Introduction									
	Background and Objectives									
2a	Scientific background and explanation of rationale	1	1	1	1	1	0	1	1	1
2b	Specific objectives or hypotheses	1	1	1	1	0	1	1	1	1
	Methods									
	Participants									
3a	Eligibility criteria for participants	0	1	0	0	0	0	0	0	0
3b	Settings and locations where the data were collected	1	1	0	1	0	1	0	0	1
3c	A table showing baseline demographic characteristics	1	1	1	1	1	0	1	1	0
	Sample Size									
4a	The sample size has been determined	0	0	0	0	0	0	0	0	0
4b	When applicable, explanation of how sample size was determined	0	0	0	0	0	0	0	0	0

Table A2. *Cont.*

Item N	Section/Topic and Checklist Item	Huang & Ren [60]	Kim et al. [1]	Lee et al. [61]	Li et al. [63]	Mohammadi & Isanejad [57]	Ndayizigamiye et al. [54]	Wei et al. [55]	Yoo et al. [53]	Yuan et al. [30]
	Procedure									
5	The procedure has sufficient details to allow replication, including how and when they were actually administered	0	1	0	0	0	0	0	0	0
	Instrument or Tools									
6a	Completely defined prespecified primary and secondary outcome measures, including how and when they were assessed	1	1	1	1	1	1	1	1	0
6b	Use of validity and reliability tools.	1	1	1	1	1	1	1	1	1
	Implementation									
7	Who made each part of study	0	0	0	0	0	0	0	0	0
	Statistical Methods									
8a	Statistical methods used to analyze the results	1	1	1	1	1	1	1	1	1
8b	Use of Methods for additional analyses to objective of study	0	0	1	0	0	0	0	0	1
	Results									
	Outcomes and Estimation									
9	A table or figure showing outputs of analysis more relevant of study	1	1	1	1	1	1	1	1	1
	Discussion									
	Interpretation									
10	Interpretation consistent with results, balancing benefits and harms and considering other relevant evidence	1	1	1	1	1	1	1	0	0
	Limitations									
11	Study limitations, addressing sources of potential bias, imprecisions, etc.	1	1	0	1	0	0	1	0	1
	Practical Implication									
12	Main applicability to results of study	1	1	1	1	1	0	1	0	0
	Other Information									
	Funding									
13	Sources of funding and other support, role of funders	0	0	0	1	0	1	1	0	0
	TOTAL	13	15	12	14	10	10	13	9	10

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