MDPI

Brief Report

A Deeper Look into Exercise Intensity Tracking through Mobile Applications: A Brief Report

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Abstract: Mobile fitness applications (apps) allow for time-efficient opportunities for physical activity. Current research suggests that fitness apps do not accurately comply with the frequency, intensity, time, and type (FITT) principle. FITT is an important principle in exercise prescription as it applies scientific evidence to improve the quality of exercise. Based on app assessment using the Fitness Apps Scoring Instrument, most fitness apps adequately address FITT in their exercise plans. In particular, fitness apps do not adequately adhere to the FITT intensity guidelines. Many apps allow the users to track their heart rate as a method of assessing their exercise intensity, but few use that information to provide real-time feedback on the intensity of the workout. For app users, awareness and education of intensity standards should be put forth in coordination with exercise professionals, rather than relying on apps alone.

1. Introduction

Prevalence of inactivity is high among adults in the United States (U.S.), with less than 50% meeting the recommended physical activity [1]. Since high levels of inactivity can be associated with increased mortality rates, this is an issue that requires attention [2]. One of the more common barriers to exercise among adults is the lack of time [3]. As technology continues to develop, there is a growing opportunity to apply time-efficient techniques through mobile applications (apps). During the 2019 coronavirus disease pandemic, the number of health and fitness apps started at approximately 78,890 in 2019, only to grow by another 16,866 apps three quarters into 2020, which equates to over a 21% growth [4]. Additionally, with 72% of the U.S. owning a smartphone device, these are highly accessible resources that can be used to combat inactivity in the U.S. [5]. There is concern around the idea that this is a viable medium for quality exercise.

1.1. Assessing App Quality

Mobile fitness apps are diverse with a wide range of features. These features include but are not limited to exercise planning, videos or images, description of exercises, goal setting, purpose of exercise, calories burned, evaluation of physical condition, exercise recommendations, list of exercises, types of exercises, activity monitoring, assessment of workout difficulty, exercise time, exercise history, and sharing progress [6]. Despite the breadth of these features, not all of them are integral to reducing sedentary behavior and increasing physical activity [6]. Moreover, not all features are deemed trustworthy by app users. The trustworthiness of an app, as determined by mobile health (mHealth) app users, relies on the information content, organizational attributes, societal influence, technology-related features, and user control [7]. The perceived trustworthiness of an app can be measured by using an mHealth app trustworthiness checklist [7]. This checklist is just one of many potential tools to determine the quality of a mobile fitness app.

Hensher and colleagues conducted a scoping review of mHealth apps to determine how the app qualities are assessed in research [8]. Their review found that apps are commonly assessed on the following domains: clarity of purpose of the app, developer credibility, content and information validity, user experience, user engagement/adherence and social support, interoperability, value, technical features and support, privacy/security/ethical/legal, and accessibility [8]. Of these domains, most studies report on the user experience, which is defined as "the overall experience of using an app in terms of its user friendliness, design features, functionalities, and ability to consider user preference through personalization function [8]". The second most reported domain is content and information validity, which encompasses the readability, credibility, quality, and accuracy of the information presented through the app [8]. These results suggest that the mHealth developers and assessors prioritize the user experience over the informational content. The information standards presented through mobile fitness apps should be derived from established public health guidelines.

1.2. Exercise Intensity

The Physical Activity Guidelines for Americans recommend a minimum of 150 min of aerobic exercise at a moderate-to-vigorous intensity per week to achieve the benefits of physical activity [2]. Meeting these minimum physical activity guidelines will help improve an individual's cardiorespiratory fitness and decrease their risk of communicable health conditions [2]. Intensity, designating whether a workout is moderate or vigorous, is one of the four primary principles of exercise that have been established by the American College of Sports Medicine (ACSM). The remaining principles include frequency, time, and type. Collectively, these principles are called the FITT principles of exercise, which encompasses the frequency, intensity, time, and type of exercise [2]. The components of FITT are inter-related to meet the desired volume of 150 min of physical activity per week. For example, when the frequency (e.g., days per week) is increased, the daily exercise time may decrease to maintain the same volume of physical activity [2]. Due to this interaction and cardiorespiratory demand, prolonged high-intensity exercise requires a higher level of fitness.

The intensity principle is of particular interest because the varying degrees of intensity in workouts performed result in different measured benefits. People who regularly participate in moderate-to-vigorous intensity workouts are associated with a longer lifespan than those who participate in light intensity workouts [9]. High-intensity workouts, independent of exercise frequency and time, are associated with improvements in insulin sensitivity, blood pressure, and body composition [10]. Meta-analytic studies reported a 28% improvement in maximum oxygen consumption and a loss of 1.3% body fat [10]. However, increasing the intensity of a workout prematurely can decrease overall adherence to exercise [11] or increase the risk of a cardiovascular event in individuals with undiagnosed clinical conditions [2]. Therefore, it is important for individuals to be aware of the different intensities of a workout and how managing the workout intensity can help them obtain their fitness and health goals. According to the ACSM FITT principle, moderate intensity is defined as 40–59% of the heart rate reserve (HRR) or oxygen uptake reserve (VO_2R) and 64–76% of maximum heart rate (HRmax); vigorous intensity is defined as 60–89% of HRR or VO_2R and 77–95% of HRmax [2].

Current research in the mobile fitness app industry reveals the unreliability of fitness apps to accurately comply with the ACSM FITT principles of exercise [8]. Regarding intensity specifically, the current research is limited in that it utilizes the self-selected intensity levels of the individual participating in the program [10]. Considering that HRR, VO_2R, and HRmax are individualized, it can be difficult for an individual to determine the appropriate exercise intensity without receiving feedback on their cardiovascular response. As a solution to this, apps have been created that pair with wearable activity trackers and smartwatches to objectively measure heart rates (HR) [12]. The caveat to this is that

individuals must trust whether these apps utilize the objective intensity measurements to give feedback for a tailored and appropriate workout.

1.3. Study Purpose

The nature of this study is to explore the quality to which fitness apps that measure heart rate will comply with the intensity component of the ACSM FITT principle. The results of this study will provide adults with knowledge of which apps in the market are more suitable to reach recommended physical activity levels based on the intensity component of the ACSM FITT principles.

2. Materials and Methods

This study was designed to mimic how mobile fitness app users search for fitness tracking apps using an iPhone Operating System (iOS) device. Search terms used to find apps in the App Store (Apple, Inc., Cupertino, CA, USA) included "fitness", "exercise", "tracking", "heart rate", "measure", "heart rate zones", and "intensity tracker" to capture fitness apps that capture intensity. HR was determined to be the intensity metric in this evaluation; therefore, the apps chosen had to include HR-tracking capabilities. Search results were then chosen based on the following criteria: they had to be fitness apps, they had to not require a purchase to download, and they had to not have a purchase requirement for their base features to be used. The term "fitness apps" refers to apps that are focused on physical fitness and not other dimensions of health, such as nutrition or stress. Apps were excluded from the evaluation if they were not fitness-related, had no HR-tracking capabilities, or required a subscription to use the app or purchases to download.

The included apps were evaluated using the Fitness Apps Scoring Instrument [13] by four coders in November of 2022. The instrument's assessment of aerobic intensity rates an app on a sliding scale of 1–5 based on whether it is advised "to monitor the intensity of aerobic activities by monitoring heart rate" [13]. Where a score of 1 reflects "no", the app did not ask users about monitoring exercise intensity. No apps, however, received this low a score because one of the inclusion criteria required a tracking measurement. Based on the scoring instrument [13], a score of 3 reflects "partially" and a score of 5 reflects "yes". For this evaluation, a value of 3 was operationalized as the app allowed users to track HR, but did not specifically indicate to monitor it. Apps were given a score of 5 if they encouraged or prompted users to track their HR and certain HR zones to determine how intense their workout was. The average scores are presented for descriptive purposes only. Percent agreement between coders and the inter-rater reliability, kappa coefficient, were calculated. The percent agreement was 1.6%, signifying that there was very little discrepancy in scoring between the coders for each app. When analyzing the data for inter-rater reliability, only three coders' scores were considered to present the majority ruling of each app. The inter-rater reliability was 75% among the 3 coders.

3. Results

As outlined in Figure 1, 23 apps were initially identified but six were excluded. There were 17 apps that proceeded to the reviewing stage of this study, but shortly after downloading the apps, five of the 17 apps were discovered to not adhere to the inclusion criteria. These five required a purchase to show the logged heart rate of a workout or to rate the intensity. The 12 remaining apps were reviewed using the Fitness App Scoring Instrument. The apps' scores were then averaged and ranked accordingly, which is depicted in Table 1. The highest average was the Gentler app, which scored 4.75. On the other hand, the lowest average was the iCardio, Simple Zones, Heart Health, and FitnessView, which scored 3. These scores reflect that apps such as iCardio, Simple Zones, Health Health and FitnessView allow the user to monitor their exercise intensity but do not require it. On the other hand, the Gentler app requires the user to track their exercise intensity and provided real-time feedback on their exercise performance based on their recorded intensity.
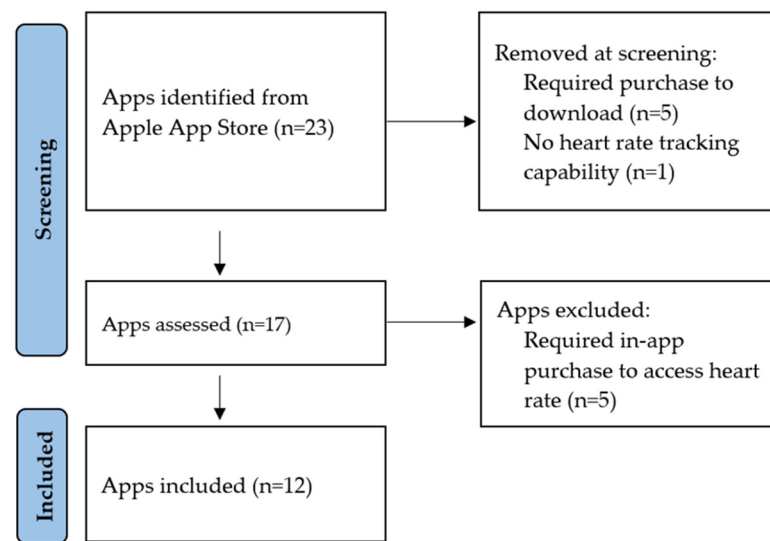
Figure 1. App screening diagram.

Table 1. Average score of apps among 4 Coders, ranked from highest to lowest.

App	Developer	Fitness App Score
Gentler Streak Workout Tracker	Gentler Stories, LLC, Kranj, Slovenia	4.75
Cardiobot Heart Rate Tracker	Majid Jabrayilov, Baku, Azerbaijan	4.25
Polar Flow	Polar Electro, Kempele, Finland	3.75
FITIV Pulse Heart Rate Monitor	MotiFIT Fitness, Inc., Moncton, New Brunswick	3.5
Google Fit Tracking App	Google, LLC, Mountain View, CA, USA	3.5
Running Trainer: Tracker & Coach	Fitness22, LTD, Petah Tikva, Israel	3.25
Zones for Training	Flask, LLP, Tokyo, Japan	3.25
Zx: heart rate zones training	OverSphere, LLC, Pembroke, MA, USA	3.25
iCardio Workout Tracker	Fitdigits, Inc., Ventura, CA, USA	3
Simple Zones Workout	Bred Ventures, Inc., Glendora, CA, USA	3
Heart Health Workout	Bred Ventures, Inc., Glendora, CA, USA	3
FitnessView Activity Tracker	Funn Media, LLC, Oak Lawn, CA, USA	3

All of the apps allowed the users to track their HR but few ($n = 2$) used that information to provide real-time feedback on the intensity of the workout. The apps that scored above 4 were the Gentler Streak Workout Tracker and Cardiobot Heart Rate Tracker. These apps scored the highest compared to the other apps because they kept HR intensity into consideration and implemented different HR (low, normal, elevated, and high) readings. It is important to note that the Gentler Streak Workout Tracker will monitor if the HR is too high, and it will advise slowing down if so. On the other hand, the Cardiobot Heart Rate Tracker implements studies from the American Heart Association to develop informed guidelines that assist in maintaining and improving the cardiovascular system.

4. Discussion

The primary focus of this study was to evaluate the quality of fitness apps that track heart rate and observe how well they compare to the intensity component of the FITT principle. The scores of 10 evaluated apps fell below an average score of 4, which suggests that the apps did not fully address the intensity principle of FITT. These results support previous findings using the Fitness Apps Scoring Instrument [13]. Guo and colleagues

evaluated 28 apps using the scoring instrument, and found that the average score was 17.8 out of a possible 70. The average score for aerobic FITT was 3.9 out of 10 in only 12 of the 28 apps that included this information [13]. The Guo et al. study established a FITT assessment tool for mobile fitness apps, but it did not differentiate between the four components in the calculated score. The current study provides further insight into the quality of aerobic intensity tracking within apps, which is an instrumental component for improved health and wellbeing [2,10,11].

Although all included apps (*n* = 12) had the tracking capabilities to monitor intensities, most of them did not comply with the intensity component of the FITT principles. Most apps (83.3%) simply displayed and stored the users' heart rates, while not indicating the desired intensity level. In these apps, there were no recommendations or guidance for the user to manage their exercise intensity while using the app.

4.1. Addressing the Knowledge Gaps

Fitness apps should offer more information on the ACSM guidelines for aerobic activity and more information on the different intensity targets (i.e., HR zones). The two apps with an average score over 4 explained the benefits and deficits of training in multiple zones. They explained how certain HR zones have been shown to offer more performance benefits, cardiovascular benefits, or the impact of intense exercise on physical stress. However, 33% of the evaluated apps do not have recommendations or warnings for high-intensity exercise, which can be harmful to novices [14]. This is supported by the data collected from this study.

Fitness app users, including individuals, researchers, and interventionists, need to be aware of the shortcomings of these apps. In the current technological era, new app innovations are regularly debuted or developed. Despite the continual improvements to mobile apps, they can lack evidenced-based exercise prescription. These apps should be used with caution among novices to help regulate the intensity of their exercise. Awareness and education of intensity standards and weekly recommendations should be put forth in collaboration with an exercise professional, rather than relying on apps to do so. While convenience is one benefit of apps in the fitness industry, it is important for apps to not trade convenience for the integrity of physical activity.

4.2. Limitations of Mobile Fitness Apps

Evaluating intensity within fitness mobile apps is limited based on the availability of an activity tracker that objectively records intensity. Some apps were only compatible with specific activity trackers, such as an Apple Watch, while others can be used with many other Bluetooth HR-tracking devices. Furthermore, app software is continuously updated, which leads to continual changes to the quality and user experience. There is also a limitation with the Fitness App Scoring Instrument [10]. The instrument does not require the evaluator to rate the quality of the intensity measurement, but solely the presence or absence of it. Some of the apps are programmed to adapt to the physiological feedback of the user after exercising for a set period based on the measured intensity. This is a valuable feature that follows the FITT principle, but it cannot be accounted for in the current version of the scoring instrument.

4.3. Study Limitations

This study is not without its limitations. The inclusion criteria restricted the sample to only free mobile fitness apps. The quality of mobile fitness apps and the implementation of intensity may greatly improve in apps that require a purchase. The current evaluation is also limited due to the availability of the mobile device operating system (e.g., iOS). This presents a selection bias as some mobile fitness app are only available on Android operating systems. In addition, the descriptive nature of this study did not assess any possible statistically significant difference in intensity values. The narrow sample of mobile

fitness apps evaluated make it difficult to make strong conclusions about the quality of intensity in all apps.

5. Conclusions

Overall, fitness apps on the market have been shown to have a lack of information about exercise intensity to produce better results for their users. The current information that is used, such as simple heart rate tracking, is not explained, and real-time feedback is not provided to the users. The few exemplary apps explain different HR zones, which, theoretically, can be better suited for novice exercisers by providing education on optimal exercise intensities [10] and improving exercise adherence [11]. Mobile fitness app users should be aware that not all apps provide high-quality evidence-based recommendations for exercise intensity.

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