



Original Research

A Descriptive Study of Objectively Measured Pokémon GO Playtime in College Students

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ABSTRACT

International Journal of Exercise Science 11(7): 526-532, 2018. Since its debut in July 2016, Pokémon GO has been a wildly popular mobile gaming app. In contrast to many previous apps, Pokémon GO requires the user to be physically active. However, the extent to which Pokémon GO contributes to physical activity is unknown. Therefore, the purpose of this study was to investigate the physical activity profile of playing Pokémon GO for 60 minutes in recreationally active college students. College students (n=27, n=19 female) were fitted with an accelerometer, pedometer, and heart rate monitor to assess the activity demands during a 60-min bout of Pokémon GO. Troiano accelerometer cut points were utilized to estimate time spent in sedentary, light, moderate, and vigorous-intensity physical activity. Of the 60-min allotted playtime, accelerometry indicated 82% was achieved via moderate-to vigorous-intensity physical activity. Pedometer counts indicated approximately 6000-steps/100-steps/min, indicative of moderate-intensity physical activity. Heart rates were approximately 50% of age-predicted maximum, also indicative of moderate-intensity physical activity. The results of this study provide evidence that playing one hour of Pokémon GO can be an effective means of accumulating recommended levels of daily/weekly physical activity.

KEY WORDS: Exergame, augmented reality games, mobile games, physical activity

INTRODUCTION

In July 2016, the mobile software application Pokémon GO (Niantic, Inc., San Francisco, CA) debuted and has been a global phenomenon ever since, with an estimated 750 million global downloads (12) and over 5 million daily users (16), making it one of the most popular mobile games ever (5). The game of Pokémon GO is based on fictional animated characters called 'Pokémon' (i.e. 'Pocket Monsters'), which debuted in the mid-1990s as Nintendo video game characters (14). Pokémon GO is considered to be an augmented reality (AR) game, in which the Global Positioning System (GPS) and camera on a user's smartphone work together to show various Pokémon characters in the real world (21).

Unique to Pokémon GO and in stark contrast to traditional computer/video games, is that Pokémon GO requires users to physically move to capture the characters in a variety of indoor and outdoor locations (21, 22). As directed from the manufacturers website, Pokémon GO

players are encouraged to “get on your feet, step outside, and explore cities and towns to capture wild Pokémon species” (13). The potential for a mobile exergame such as Pokémon GO to facilitate behavior change by either increasing physical activity and/or decreasing sedentary behaviors, is a very intriguing possibility for public health purposes (10, 21). However, the effectiveness of Pokémon GO has yet to be determined (1) and furthermore, the extent to which Pokémon GO contributes to physical activity recommendations is largely unknown.

Therefore, the purpose of this study was to determine the physical activity profile of Pokémon GO by objectively measuring 60-minutes of Pokémon GO playtime in recreationally active college students.

METHODS

Participants

A convenience sample of recreationally active college students ($n = 27$, 19 female, age 21.5 ± 1.6 y, height 169.9 ± 9.6 cm, body mass 70.5 ± 12.6 kg, BMI 24.3 ± 2.9) were recruited for this study. Inclusion criteria required physically active participants in good health. Students with any musculoskeletal injuries or other health problems that would inhibit the ability to walk for 60-minutes were excluded from the study. All participants signed informed consent documents and completed a Physical Activity Readiness Questionnaire (PAR-Q) before participation. The University of Minnesota’s Institutional Review Board approved this study, and all participants completed the study with no injuries reported.

Protocol

Upon reporting for testing, anthropometric measurements were collected. Participants were then fitted with the following validated devices: 1) accelerometer (ActiGraph GT3X+, ActiGraph Corporation, Pensacola, FL) on the right iliac crest to quantify time spent in sedentary, light, moderate, and/or vigorous-intensity physical activity (15); 2) pedometer (Omron HJ-303, Omron Healthcare, Inc., Bannockburn, IL) on the left iliac crest to determine total step count (17); 3) analog electrocardiogram (ECG) heart rate (HR) monitor and watch (Timex Personal Heart Rate Monitor, Timex Group USA, Inc., Middlebury, CT) around the sternum/left wrist to measure average and peak HR (4).

All participants were issued the same smartphone (iPhone 6, Apple Inc., Cupertino, CA) that had previously downloaded the Pokémon GO mobile app. Prior to the beginning of testing, participants were given a tutorial on how to play Pokémon GO and given the opportunity to ask any questions. For safety and logistical reasons, a boundary consisting of a 2-mile campus radius was utilized so that participants would not cross any streets. Participants were accompanied by a member of the research team at all times throughout the 60-minute playtime to answer any questions and ensure the safety of the participants. Upon completion of the 60-minutes of playtime, participant data were subsequently downloaded and recorded.

Statistical Analysis

Accelerometer data were scored using ActiLife software (Version 6, ActiGraph Corporation, Pensacola, FL) with Troiano cut points scaled to 60-second epoch lengths (counts per minute = CPM) for sedentary (0-99 CPM), light (100-2019 CPM), moderate (2020-5998 CPM), and vigorous-intensity physical activity (> 5999 CPM) (18). All subsequent data were analyzed via descriptive statistics (means ± SD) using IBM Statistical Package for the Social Sciences (version 21). Preliminary data analysis indicated no significant differences between gender or previous Pokémon GO experience for any measure, therefore all data were presented as group means ± SD.

RESULTS

Table 1 shows descriptive statistics for average heart rate, peak heart rate, and steps. As presented in Table 1, heart rates were approximately 50% (average) and 67% (peak) of age-predicted maximum, indicative of light to moderate-intensity physical activity (2). Pedometer counts indicated approximately 6000 steps over 60-minutes, which extrapolates to ~100 steps/minute, also indicative of moderate-intensity physical activity (6).

Table 1. Descriptive statistics of 60-min of playing Pokémon GO.

Avg HR (bpm)	Peak HR (bpm)	Total Steps	Steps/min
100.3 ± 11.3	133.8 ± 17.7	6006.2 ± 569.4	100.1 ± 9.5

Table 2 shows descriptive statistics for accelerometer-measured time spent in sedentary, light-intensity, moderate-intensity, and vigorous-intensity physical activity, whereas Figure 1 presents percent activity time by accelerometer cut points. Of the 60-minute allotted Pokémon GO playtime, accelerometry indicated 82% was spent in moderate-to vigorous physical activity.

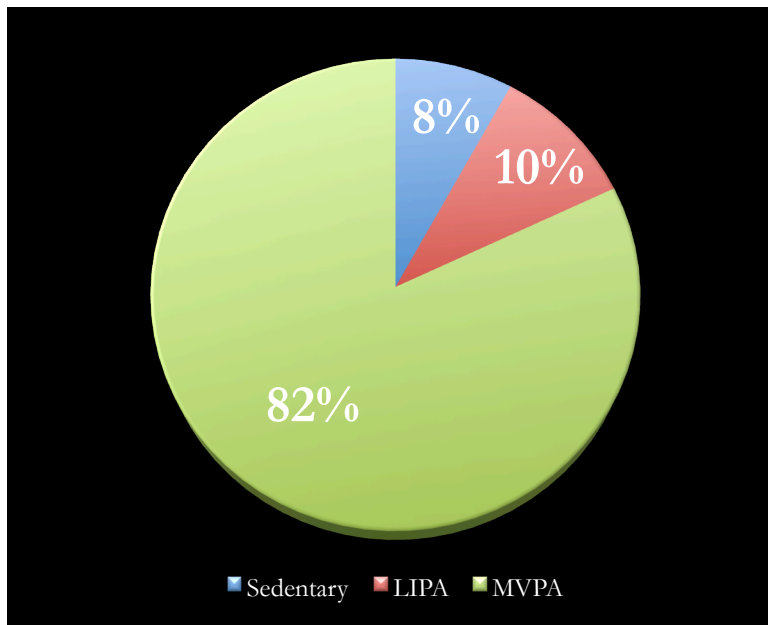


Figure 1. 60-minute profile of Pokémon GO by accelerometer cut points.

Note: LIPA = light-intensity physical activity; MVPA = moderate to vigorous-intensity physical activity

Table 2. Time spent in accelerometer-measured physical activity intensity levels.

Sedentary (min)	Light (min)	Moderate (min)	Vigorous (min)
4.9 ± 3.0	6.1 ± 3.9	48.8 ± 5.3	0.2 ± 0.4

DISCUSSION

The purpose of this study was to determine the physical activity profile of the mobile gaming app Pokémon GO by objectively measuring 60 minutes of Pokémon GO playtime in recreationally active college students. The results of this study provide initial evidence that playing one hour of Pokémon GO can be an effective means of accumulating recommended levels of daily/weekly physical activity (2). Objectively measured HR, step counts, and accelerometry all indicate that within this sample of recreationally active college students, playing Pokémon GO reached previously established thresholds indicative of moderate-intensity physical activity.

Due to the novelty of Pokémon GO, comparisons to previous research is quite limited, as the majority of previous research has utilized either subjective measures such as self-report online surveys/questionnaires (10, 21), or step counts recorded by smartphone applications (1, 5, 22) to assess physical activity. The potential for reporting bias or recall problems associated with self-report instruments is a well-known limitation (19), whereas measuring step counts with smartphone applications that have not been well validated (3) is also a serious limitation of previous Pokémon GO research. Thus, our study is noteworthy and unique in that we are the first study of Pokémon GO that has utilized objective, validated, and reliable physical activity assessment devices, whereas the aforementioned studies did not. Therefore, the following comparisons of the present study with previous Pokémon GO studies do warrant caution.

Nevertheless, in a pre-post 6-week observational study of 167 Pokémon GO players, Xian et al. found an average increase of 1976 steps per day, which equated to a 34.8% increase over baseline physical activity levels, with self-reported time playing Pokémon GO ranging from 1.0-2.5 hours per day (22). Similarly, in a survey of 1182 smartphone users 6 weeks after installing Pokémon GO, Howe et al. found an initial increase of 955 steps per day, approximately a 24% increase over baseline (5). Likewise, in an experimental 30-day query of 1420 Microsoft product users, Althoff et al. found the effect of Pokémon GO on physical activity led to an increase of 1473 steps per day, a 26% increase over baseline (1). It is important to note that neither Howe et al. nor Althoff et al. reported daily Pokémon GO playtime. Additionally, whereas all of the aforementioned studies indicated an initial increase in steps per day over baseline measures, Howe et al. and Althoff et al. both reported attenuations in steps over the subsequent weeks to near baseline levels.

The relatively modest increase in steps observed in each of the aforementioned studies stands in stark contrast to the 6000 steps per hour we measured with a validated research-grade pedometer (17). If the participants in our study played Pokémon GO at a pace of approximately 6000 steps per hour/100 steps per minute, which translates to approximately a 3 mph walking pace (20) whereas the participants in previous studies accumulated ~1000 steps per hour, which extrapolates to ~17 steps per min/~0.5 mph walking speed, one of two

plausible explanations remain: 1) the participants in our study utilized a markedly different play strategy than did participants in previous studies or 2) the reported step counts from previous studies reflect measurement error so severe that it questions the validity of the smartphone step counts being reported. It is the opinion of the authors of the present study that the latter is the more likely explanation. As evidence, previous research on smartphone pedometer applications has indicated the apps were neither valid nor consistent, in both laboratory and free-living conditions (7, 11). Furthermore, it has been relatively well established that pedometers undercount steps, especially at speeds less than 2 mph (9). Thus, given the very low walking speeds extrapolated from the observational Pokémon GO studies, coupled with known measurement issues related to slow walking speeds, discretion is advised when comparing potentially circumspect results.

The present study is not without limitations. Whereas our stated purpose was to simply provide a 60-minute physical activity profile of Pokémon GO, the utilization of such a discrete, intentional play bout does limit generalizability and is duly noted. However, in contrast to the previously discussed observational studies, which allowed participants to play *ad libitum*, the use of a standardized bout of playtime does allow future researchers to replicate our study to a much greater extent. Moreover, the participants in this study were healthy, recreationally active college students; therefore, generalizations of our findings towards less active or non-healthy populations should proceed with caution. In addition, each participant was accompanied by a research assistant throughout the 60-minute playtime. Whereas the primary rationale for the accompaniment was to ensure subject safety from distracted walking, we cannot rule out the potential for a Hawthorne effect on observed behavior. Finally, the Pokémon GO gaming experience of our participants may not reflect the same experience among other Pokémon GO enthusiasts. Our participants were largely playing by themselves and may have adopted more of an exercise/physical activity approach to the game, whereas individuals playing with friends for social reasons may adopt a much more leisurely pace when playing.

In conclusion, the results of this study found that 60 minutes of Pokémon GO playtime in recreationally active college students meets multiple thresholds equivalent to moderate-intensity physical activity. Results from this study suggest that Pokémon GO can be an effective method towards accumulating daily/weekly physical activity goals such as previously established evidence-based targets such as 10,000 steps or 150 minutes of moderate-intensity aerobic exercise per week (2). Future studies of Pokémon GO are encouraged to utilize objective and validated physical activity measurement techniques and to explore the impact of longer-term interventions of Pokémon GO on indices of health and exercise adherence.

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