



Player tracking in Soccer: Is a newly developed GPS tracking device fit for purpose?

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Headline

Global Positioning System (GPS) technology has been increasingly used for a number of years to monitor player performance during training and match-play (1). Furthermore, during the COVID-19 pandemic, match-play and training in soccer changed (2), with restrictions including remote training and reduced numbers. These changes resulted in players having to train away from their usual support network, coaches and support staff unable to collect data and monitor players as before (3) and raised the question of what alternatives there are and the cost benefit to use.

Aim

To evaluate a recently developed GPS technology as a method of collecting player physical data and compare this with an existing, established GPS technology already being employed in football.

Methods

Experimental approach to the problem

This study was designed in two parts, using two types of GPS tracking technology, an existing model, Playertek (Catapult group Australia) and a newly developed one, Pitchero GPS (Pitchero UK). The aims were to first establish the accuracy of the new system by comparing over a measured distance at various speeds; and secondly to

assess the usability of both under new and changing restrictions due to COVID-19. The first part involved these devices being worn over a 20-meter shuttle course in total 300 meters to quantify total distance and speeds at walking jogging and running so five shuttles of each in total 100 meters for each component (Figure 3.)

Then a device of each brand Playertek and Pitchero was placed into a purpose-built garment supplied by each company (Figure 2.) and worn by participants these were then worn to perform the tests as described.

The second part of the study was to report on the process of gathering and analysing the data from two operators accustomed to using the equipment.

Participants

A group of mixed level participants from semi-professional to leisure league level football that regularly take part in football training and match play ($n = 6$ with a mean age of 19 ± 9 years female $n = 1$ male $n = 5$, training age 11 ± 6 years) took part in this study. All participants consented to take part and confirmed that they were able to participate in the study physical tasks and were accustomed to performing as part of their training. All participants performed two familiarisation sessions. In addition, two operators were recruited as part of their normal duties in their roles as support staff

in professional football, who were accustomed to operating the GPS systems being used for the study.

Study design

Part 1: a total of 12 GPS devices from 2 different types of GPS tracking type devices 6 being Playertek (Catapult group Australia) 6 being, Pitchero GPS (Pitchero, UK) on an all-weather 4th Generation AstroTurf playing surface football pitch 4 cones were placed 20 meters apart (Figure 1.) to form a channel. Participants carrying both devices in a purpose-built garment were then instructed to perform the following and at the expected pace as described, first walked <6 km·hr⁻¹ between the cones five times turning at each cone 180°, travelling in total 100 meters.

This was then repeated at a faster pace to replicate jogging 6.1-12 km·hr⁻¹. The test was then repeated at a faster pace to replicate that of running >12.1 km·hr⁻¹. The data was then immediately harvested from all the devices using each systems software to crop the data and then export the data to excel ready for analysis (Figure 3.)

Then Two devices (One of each system) were placed into the manufacturer-provided vest so that participants wore two vests. The six subjects then repeated the same test as before, but this time in addition to the 20 meters they also performed a 10 meters shuttle test, an additional 50 meters. (Table 1.). All participants then performed 5 minutes of football activity that consisted of a passing drill commonly employed as part of a general football training session, in an area 20 meters x 30 meters, replicating the movement and running patterns commonly performed in football training (Table 2).

Part 2: On completion, two operators accustomed to operating the equipment performed data uploaded for analysis. Data was cropped so as to only use the actual activities performed in parts 1, and 2, all other data was excluded. Data collected for analysis from all devices included: total distance covered measured in meters and maximum speed (km·hr⁻¹). A comparison on usability was assessed employing a qualitative approach. This approach involved the two operators to give a commentary and report on experience of performing the task.

Statistical analysis

Analyses were conducted to determine the reliability and validity of distances travelled. Data was presented as absolute, mean, SD and 95% confidence intervals. First, to analyse the reliability of all the devices used for measuring the total distances employed, and to analyse coefficient of variation (CV) were used. Secondly to analyse the two different types of GPS tracking device for significant differences.

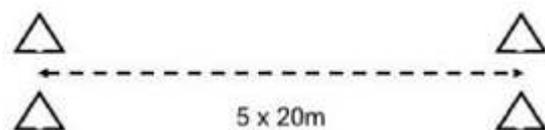


Figure 1. 20 meter shuttle channel layout.



Figure 2. Garment & pocket for housing of GPS devices.

Results

During the walking test the mean distance measured was similar for both products (10 m: Playertek: 97.8 ± 3.3 m; Pitchero: 98.7 ± 2.1 m; $t(10) = 0.345$, $P = 0.737$; 20 m: Playertek: 98.2 ± 1.8 m; Pitchero: 102.0 ± 5.7 m; $t(10) = -1.561$, $P = 0.149$). Similar results were observed for jogging (10 m: Playertek: 97.1 ± 2.1 m; Pitchero: 101.5 ± 1.05 m; $t(10) = -0.083$, $P = 0.934$; m: 20 m: Playertek: 96.2 ± 0.4 m; Pitchero: 98.7 ± 4.2 m; $t(10) = -1.442$, $P = 0.180$) and running (Playertek: 99.7 ± 2 m, Pitchero: 97.8 ± 5.2 m; $t(10) = 1.677$, $P = 0.0.124$; 20 m: m: Playertek: 97.3 ± 2.8 m; Pitchero: 99.0 ± 4.8 m; $t(10) = -0.732$, $P = 0.481$).

Table 2. Comparison of two GPS devices worn together during football activity.

Playertek	Pitchero	average	SD	COV
282	274	278	5.66	2.03
145	156	151	7.78	5.17
331	322	327	6.36	1.95
467	451	459	11.31	2.46
489	520	505	21.92	4.34
392	354	373	26.87	7.20

Table 1. Comparison of 2 GPS systems in a 10 and 20 meter shuttle test.

	Playertek 1	Pitchero 1	Playertek 2	Pitchero 2	Playertek 3	Pitchero 3	Playertek 4	Pitchero 4	Playertek 5	Pitchero 5	Playertek 6	Pitchero 6
10m walks	59	52	53	61	52	51	52	45	53	52	59	61
10m jogs	52	51	51	58	52	50	58	49	51	51	52	58
10m runs	57	52	53	50	47	50	51	46	53	52	57	50
Average(m)	56±4	51.7±1	52.3±1	56.3±6	50±3	50±1	54±4	47±2	52±1	52±1	56±4	56±6
COV	6.4	1.1	2.2	10.1	5.7	1.1	7.1	4.5	2.2	1.1	6.4	10.1
20m walks	96	101	100	113	99	100	98	96	100	101	96	101
20m jogs	96	99	96	103	96	96	97	92	96	99	96	103
20m runs	100	100	96	103	93	98	99	90	96	100	100	103
Average	97±2	100±1	97±2	106±6	96±3	98±2	98±1	93±3	97±2	100±1	97±2	102±1
COV	2.4	1	2.4	5.4	3.1	2	1	3.3	2.4	1	2.4	1.1

COV: coefficient variation.

Usability

Observation and feedback from users were that both systems were easy to use, for fit and feel both were reported as being similar.

When it came to gathering data from devices the Pitchero system was reported to be far easier as all the devices only needed to sync with a tablet via wireless connection.

Both operators reported that Pitchero download to upload to viewing data was far quicker than Playertek, Figure 4. And commented:

“The Pitchero system allows for data to be accessed within a much shorter time period than the Playertek system due to being completely wireless, therefore allowing data to be uploaded instantly after a session”

“The Playertek system is wired, and also requires an active internet connection for the data to sync successfully via usb leads, docking port and laptop, the Pitchero system I just need a tablet as its all wireless”

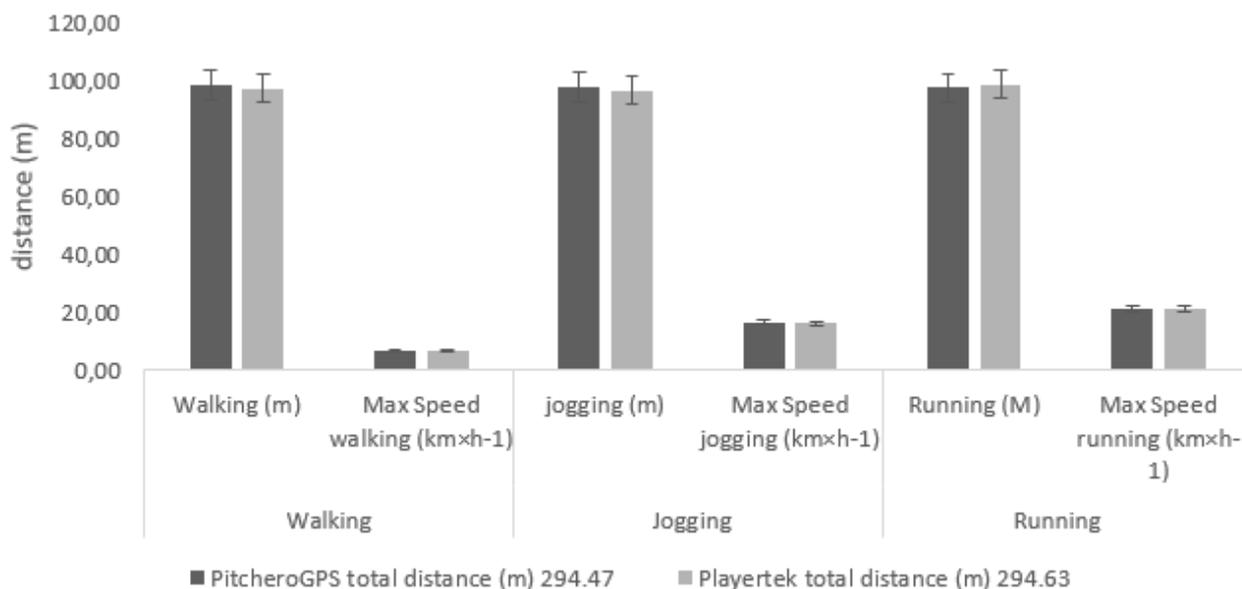


Figure 3. Comparison of two GPS systems over a measured distance and speeds 5 x 20 meter shuttles total distance of 100 meters.



Figure 4. Playertek and Pitchero of downloading devices.

Discussion

The findings from this current study support the already large volume of research into the reliability and validity of GPS type tracking devices commonly employed within Soccer (4). It is clear that (Pitchero GPS) is valid and reliable when compared to established systems (Playetek). However, until now, the vast majority of studies have only evaluated the more expensive and complex type of systems as used at an elite level (9). The number of metrics provided and reported on were kept to just those that could be compared accurately and known (distance, speed). This does highlight that with more complex systems not allowing access to raw data and algorithms employed to determine metric parameters, causing confusion and disparity. This further highlighted that in keeping with other studies, that care should be taken when comparing metrics between systems given the thresholds set may conflict between each system (4,5).

These more affordable systems are worthy of investigation as more become widely available, budgets become ever increasingly tighter and more teams further down the football pyramid may see this as an affordable alternative to those used at an elite level. Furthermore, with simple, understandable metrics then more users will be able to relate to the insights being presented.

With the recent worldwide pandemic of COVID-19, football and society are facing many new challenges in an unprecedented ever-changing fluid landscape that needs to adapt and be innovative to overcome and progress (8). A good example of these changes is the shift towards a hybrid coaching approach (10) allowing for more mobile and remote monitoring of players. With the emergence of the 4th industrial revolution, GPS technology employed in football, like all wearable technology, is changing.

These changes are, in part, due to technology advancing and also with the aforementioned changing sporting landscape and the wider society (6). The ability to monitor players physical performance with a wider range of devices allows for more accessibility as more of these types of devices become available throughout the football pyramid.

Additionally, advances in mobile communications such as Bluetooth and Wi-Fi are allowing for more mobile and remote workings (7), accessible and adaptable. These systems are more user-friendly than the types of systems that require a multi-unit hub or docking station and central download-upload through software installed on a laptop or computer. Whereas a system that can use wireless type download-upload and employ a cloud-based software is more aligned to the changing needs and advances in technology. Thus, allowing coaches and support staff to monitor and feedback to players on their performance even at the side of the pitch Figure 5. Indeed, players themselves could use this type of system therefore individualising feedback and further reducing contact with others.



Figure 5. Wireless mobile download at side of pitch using Pitchero system.

Football has to look differently at how they work in the future to continue to accommodate advancing technology, evolving hybrid coaching approaches (10) and more individual and remote workings that is increasing in our modern society (1,8). As this study has shown, companies are embracing and able to accommodate changes. this study has given reassurance that GPS type tracking systems entering the market can be as reliable and valid as those already established and in mainstream use.

Practical Applications

Knowing that GPS tracking type devices give similar outputs gives coaches and players the assurance that accuracy and reliability is not adversely affected regardless of system used and that by conducting a simple test such as these used in this current study allows them to evaluate to better fit their requirements. Systems developed can accommodate changes from external factors such as those imposed during and beyond COVID-19 Pandemic and evolving hybrid coaching approaches.

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