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## Research Review: More than fashion: The risk of wearable technology

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# RESEARCH REVIEW:

## MORE THAN FASHION: THE RISE OF WEARABLE TECH

Sales of activity monitors are through the roof, and Santa will be stuffing a fair few in stockings this Christmas. But are they really doing what they claim?



**WORDS:** ASSOCIATE PROFESSOR MIKE CLIMSTEIN & JOE WALSH

**Title:** Comparison of different activity monitors

**Author:** Yang Bai (MSc) et al. (Dept of Kinesiology Iowa State University & University of Nebraska (Omaha), USA)

**Source:** *Medicine and Science in Sports & Exercise* (2015). ePub ahead of print.

**Introduction:** It's always pleasing to save a couple of hours hunting for something by discovering the ideal candidate at the very start of your search.

When it comes to selecting which recent research to review for *Network* magazine, Joe and I usually spend two or three hours each on a Sunday evening completing journal searches, before Skyping to deliberate over the various merits of those we've shortlisted. We then develop a spreadsheet of all the eligible articles, which we then rank, listing their individual pro's and con's and assigning each of them a 'readers interest' ranking. To sum up: it's a fair amount of work preparing, however we actually write the Research Review in a fairly short period of time. Well, Christmas came early this year, as we were pointed in the direction of this issue's research article by *Network's* editor, and it ticked all the boxes.

The article, 'Comparison of different activity monitors', is hot off the press (i.e. published online ahead of print) and could not be more timely or appropriate as activity monitors are clearly the newest fad for fitness enthusiasts and fitness professionals. Actually, we retract that word 'fad' because we believe they are here to stay and will only improve (i.e. become more

accurate) over time. At the clinic I conduct a number of health assessments, and one of the preventative assessments is with adults (aged 45 to 49) who are at risk of developing a chronic disease. The majority of the active individuals I have seen thus far have enquired about the potential benefits of these devices and asked if they are worth the money. Good question.

Lead researcher Yang Bai and her colleagues state that last year approximately 23 million wearable activity monitors were sold, and CNET reports that the number bought so far this year is already triple that, with 70 million units shifted globally. For those of you who may be unfamiliar with these devices, which are generally worn on the wrist, manufacturers claim activity monitors can track your daily exercise activities, assist in weight loss by tracking your caloric expenditure, and improve your overall health. A number of activity trackers even monitor your sleep patterns. The purpose of Bai's study was to investigate the accuracy of a selected number of commercially available activity monitors with regards energy expenditure (Kcal expenditure).

**Methods:** A total of 52 individuals (18 to 65 years of age) were asked to complete 20 minutes of sedentary activity (such as reading or watching movies), 25 minutes of aerobic exercise on a treadmill (self-selected speeds) and 25 minutes of resistance training (self-selected intensity, 12 exercises). Study participants took five-minute breaks between sessions, totaling 80 minutes of monitored activity.

While completing the exercises, each

individual wore five activity monitors on their wrist (FitBit Flex, Jawbone Up24, Misfit Shine, Nike+ Fuelband SE, Polar Loop), one monitor on their waist (Actigraph GT3X+) and one monitor on their arm (BodyMedia Core). The data recorded by all of the monitors was compared to a portable gas analysis system (Oxycon Mobile) which analysed expired gases to determine their accuracy. All of the activity monitors provided real-time monitoring of energy expenditure, and data was obtained either from monitor-specific apps on an iPad or directly from the device.

**Results:** The recorded mean total energy expenditure for the 80-minute session ranged from 274.5 Kcals (Nike+ Fuelband SE) to 395.5 Kcals (Misfit Shine): the actual energy expenditure, as determined by the Oxycon Mobile unit, was 316.8Kcals. This indicates that energy expenditure was underestimated by approximately 22 per cent on one of the monitors and overestimated by approximately 24.6 per cent on another, which is a fairly wide range.

As the results in Table 1 show, the ActiGraph GT3X provided the closest estimation of energy expenditure for the 80 minute session (-3.4%) while the Misfit Shine appeared to have significantly overestimated the actual energy expenditure (24.8%). With regard to the different exercise conditions (sedentary activity, aerobic exercise and resistance training), the BodyMedia Core provided the best estimation of sedentary activity (+11.2%), aerobic exercise (+7.4%) and resistance training exercise (+18.3%). It is worth mentioning that one of the monitors overestimated the energy expenditure of aerobic exercise by 58.1 per cent, while

another underestimated energy expenditure by 57.3 per cent during resistance training activities.

The authors concluded that some of the consumer monitors provided a comparable accuracy in estimating energy expenditure. Trainers should note that there may be a great deal of inaccuracy in current activity monitors, and while they may serve purposes, such as motivation for clients, the accuracy in quantifying training loads may vary greatly (depending upon the monitor used and the activity performed).

**Pros:** This was a good, practical study and the only one we could locate that investigated the accuracy of general use commercially available activity monitors.

Individuals considering purchasing an activity monitor would benefit greatly by reading the article in its entirety, particularly with emphasis on the accuracy of the various monitors specific to the intended use of the exerciser. It is important to note that although these devices are simplistic in appearance, they were compared to an expensive, sophisticated (and accurate) laboratory grade scientific analyser.

**Cons:** The conditions in which the participants completed the activities were quite varied. It would have been beneficial to have more stringent conditions (i.e. same aerobic exercise, resistance training exercises and intensities), although the use by participants is clearly a more real world approach. It should also be noted that, unfortunately, the Polar Loop was

**Table 1. Recorded energy expenditure in activity monitors**

Monitor	Total energy expenditure (Kcal/80mins)	Difference (Kcal)
Oxycon Mobile (base used for comparison)	316.8	- -
ActiGraph GT3X	305.9	-10.9
Fitbit Flex	337.2	+20.4
Jawbone Up24	290.7	-26.1
BodyMedia Core	351.0	+34.2
Nike Fuelband SE	274.5	-42.4
Misfit Shine	395.5	+78.7

Note: adapted from Table 1 (Bai et al., 2015)

removed from data analysis due to technical problems.

We are aware that some activity monitors have heart rate monitoring capabilities, and we look forward to locating a published study which investigates the accuracy of activity trackers on exercise heart rate. **N**

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**The 30-second article**

- Sales of wearable activity monitors have more than tripled in the last year
- Manufacturers claim activity monitors can track daily exercise activities, assist in weight loss by tracking caloric expenditure, and improve overall health
- Researchers conducted a study to gauge the accuracy of a range of monitors, using a highly accurate gas analysis system
- The most accurate device recorded energy expenditure to within a 4% margin of error, while the least accurate overestimated energy expenditure by almost 25%

