EFFECT OF WEARABLE FITNESS WATCH ON PHYSICAL ACTIVITY IN SCHOOL CHILDREN WITH OVERWEIGHT

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Obesity in children and adolescents is a significant health problem, and lack of physical activity may be a factor related to obesity. In this study, we explored the wearable fitness watch to monitor the physical activity promoted situation of overweight and obese schoolchildren. Participants were overweight schoolchildren divided into two groups, the study group (n=41) and the control group (n=44). In the control group, the wearable fitness watch only displays the time. In the study group, each week, participants set up the goal, which increases the steps by 10% from baseline steps to reach 10,000 steps. The ANOVA is adopted to analyze the parameters such as the average daily number of steps, moderate to vigorous physical activity (MVPA). The results indicated the study group increase and improved daily walking steps and MVPA accumulation time in 8 weeks. The wearable fitness watch can help to promote the physical activity of overweight children.

KEYWORDS: accelerometers, wearing technology, physical activity

INTRODUCTION: Physical activity (PA) can improve cardiorespiratory and muscular fitness, bone health, and function of the cardiovascular system and metabolic health biomarkers. World Health Organization (WHO) guideline suggested that children and adolescents need to accumulate at least 60 minutes PA a day, and that includes free play, games, sports, transportation, chores, recreation, physical education, or planned exercise. However, only about 23% of school-age children accord with the suggestion (Trembla et al., 2014). Insufficient PA of elementary school students had resulted in an increase in the obesity rate year by year, further causing the health threat, the reduction of physical fitness, and cardiovascular and chronic diseases after adults. Regular walking exercise is useful to increase cardio and muscular function and is the easiest to do. The number of steps often is used to measure the intensity of PA. Accelerometers can measure the object's acceleration in motion along the axis of reference and reflect step-counter (Steele et al., 2010). Previous studies showed both uniaxial and triaxial accelerometers could report the frequency and intensity of human movement (Schneider, Crouter & Bassett, 2004).
Additionally, in the case of wearable, obtaining is not only easy also accurate by accelerometers. A wearable fitness watch is a uniaxial accelerometer for monitoring PA devices that have been attending for their monitoring and tracking health and fitness-related metrics and provide instant feedback to the user(Hansen et al. 2012). Therefore, we explored the wearable fitness watch stage strategy to monitor the PA promoted situation of overweight and obese schoolchildren in this study.

METHODS: Participants: Eighty-five overweight school children (BMI≧21) from Taipei county participated in this study. The participants were randomized, divided into two groups, the study group (n=41, 21 boys, 20 girls) and the control group (n=44, 22 boys, 22 girls). Participants and their parents gave written consent to participate in this study. And ethical approval was received from the local university Institutional Review Board. Necessary physical information for the two groups showed table.1.

Intervention: All participants wore fitness watch (Wisme: CXL50LP3 3-Axis Accelerometer ± 25g) for one week without instruction to collect basic fitness data and conducted BMI (overweight rate: BMI≧21, obesity rate: BMI≧23) measurements, before and after the 8-week experimental intervention, respectively. In the control group, no goal and instruction were given during the study period. For the study group, each week, participants were

instructed to set the goal for increasing the number of steps by 10% from baseline steps to reach 10,000 steps (Martinez-Gomez et al. 2010). The wearable fitness watch was undertaken to observe physical activity intensity and time changes for both groups. The result of PA intensity and time would instant feedback to the user by step, distance, completion rate, and activity (Figure 1).

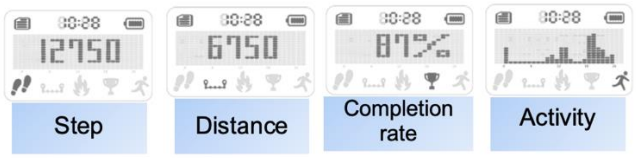

Figure 1: PA intensity and time instant feedback.

Statistical analysis: The SPSS version 22.0 software was used to perform. The significance level was set α = 0.05. The descriptive statistics were used to examine the necessary physical information of two groups. The mixed-design of two-way analysis of variance ANOVA is adopted to analyze the parameters such as the average daily number of steps, moderate to vigorous physical activity (MVPA) accumulation time, and movement step frequency.

Table 1: Necessary physical information for each group.

	study		control		p	ES	Power
	M	SD	M	SD			
age (years)	11.5	1.82	11.45	2.11	0.09	0.65	0.4
hight (m)	1.4	0.05	1.42	0.05	0.21	0.55	0.25
weight (kg)	45.12	6.1	44.24	7.08	0.32	0.42	0.18

RESULTS: In the study group, the overweight rate decreased by 43.75%, and the obesity rate decreased by 11.1%, and the control group, the overweight rate decreased by 14.7%, and the obesity rate increased by 9% (Table.2).

Table 2: BMI (kg*m-2) of overweight and obese rate within groups before and after the experimental intervention

	Study		Control	
	overweight	obese	overweight	obese
Before	32	9	33	11
After 8 weeks	18	8	28	12
Overweight, obese reduction rate% (people)	43.75	11.1	14.7	-9

In the study group, the 8-week wearable fitness watch intervention could promote the PA intensity of elementary school students to increase, achieving significant differences ($F=10.23$, $p<.05$), and significantly improved daily walking steps and MVPA accumulation time (Table. 3).

Table 3: Step, intensity, MVPA within groups before and after the experimental intervention

	Before		After 8 weeks	
	Study	Control	Study	Control
Step	6683±1795	6728±1824	10293±2453*	7099±1865
Intensity (step/min)	82.3±1.72	84.75±2.03	116.42±2.14*	103.14±1.85
MVPA (min)	25.36±10.61	26.6±11.13	56.3±13.36*	32.84±12.44

* $p<0.05$ statistically significant.

DISCUSSION: In the present study, we investigated the effect of wearable fitness watch on PA in overweight schoolchildren. Our study results showed that the study group decreased BMI of overweight and obese rates. This result supports the conclusions of Martínez-López et al. (2012) reported that wearable was associated with significant gains to improve PA by instant feedback in six weeks. Children can be encouraged to exercise while having fun with training goals, and more noticeable results can be obtained bodyweight control (Martinez-Gomez et al. 2010). The findings underline the need to increase PA in obese and overweight children, and the pedometer can promote autonomous motivation (Standage et al., 2008).
There was a significant improvement in physical activity intensity and MVPA in our study. Laurson et al. (2008) observed that most overweight peoples had low steps count. The weekend days are 12,000-13,000 steps per day in boys and 10,000-12,000 steps per day in girls (Sigmund et al. 2009). Still, we found all participants before the experimental interventions were low active level (study 6,683 ±1,795 steps and control 6,728±1,824 steps) and MVPA less than 60 minutes a day (Tudor-Locke and Bassett, 2004). Still, after eight weeks of experimental intervention, the study group showed an active level. The results expressed that wearable fitness watches with setup goals could increase the number of steps and MVPA (Dudley, Okely, Pearson, & Cotton, 2011). Also, the study group showed high MVPA performance, which indicates that setting goals are good for PA.
The activity tracking technology of wearable fitness watch may help to stay consistent with the everyday program and provide a way to continuously monitor and regulate the program to track and record the progress(Cheatham et al. 2018). Having this in mind, wearable fitness watch with attainable goal-directed toward PA would be beneficial in children with overweight, as it enables children to train while having fun with increased compliance to the exercise(Duncan, Birch, & Woodfield, 2012).

CONCLUSION: The wearable fitness watch with a clear setup goal can help to promote physical activity. Through the wearable fitness watch, strategy intervention accurately understands and effectively enhances the intensity of physical activity of overweight and obese schoolchildren. However, whether the functional improvement can be maintained in the long-term is still unclear. Further long-term studies would be valuable to evaluate the persistence of the effect of a wearable fitness watch.

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