"Change in Waist Circumference with Continuous Use of a Smart Belt: An Observational Study"

Myeonggyun Lee, MS\textsuperscript{3}, Jaeyong Shin, MD, MPH\textsuperscript{1,2*}

\textsuperscript{1}Division of Biostatistics, School of Medicine, New York University, New York City, NY, USA

\textsuperscript{2}Department of Policy Analysis and Management, College of Human Ecology, Cornell University, Ithaca, NY, USA

\textsuperscript{3}Department of Public Health, Graduate School, Yonsei University, Seoul, Korea

Corresponding author: Jaeyong Shin, MD, MPH

Department of Policy Analysis and Management, College of Human Ecology, Cornell University, Ithaca, NY, USA

Tel: +1 (607) 216-7511

E-mail: js3483@cornell.edu
Abstract

Background: Health insurers and policymakers are trying to prevent and reduce cardiovascular diseases due to obesity. A new concept for conquering obesity, that is, a smart belt that monitors activity and fullness has been introduced, which may be a promising new strategy for health insurers and policymakers.

Objective: This preliminary study evaluated whether use of a smart belt, decreased waist circumference.

Methods: Paired t-tests and repeated measurements analysis of variance (ANOVA) were used to identify the change in waist circumference by specified time intervals (at 4, 8, and 12 weeks). In addition, a linear mixed model was used to incorporate all subjects’ waist circumference data at each time point. Preexisting data on waist circumference and self-reported demographics were obtained from the manufacturer of the smart belt (WELT Corporation, Korea). In the database, a total 427 men were evaluated.

Results: Compared with baseline, the waist circumference (inches) decreased significantly at all time points (week 4, $\beta=-0.106$; week 8, $\beta=-0.300$; week 12, $\beta=-0.776$; $P<.01$). Although each paired t-test had a different sample size because of loss to follow-up, the differences between baseline and each subsequent week increased. Equal continuous reduction in waist circumference was observed with the ANOVA and mixed model analysis ($\beta=-0.056$, every week).

Conclusions: The smart belt is a newly developed, wearable device that measures real-time steps, sedentary time, and waist circumference. In this study, the smart belt helped users decrease waist circumference over 12 weeks. This direct-to-consumer smart health device may contribute towards reducing the risk of obesity and related conditions and controlling increasing health costs for health insurers.
Keywords: Smart healthcare; Wearable device; Obesity; Internet of things; mHealth; Digital healthcare; Lifestyle modification; Metabolic syndrome
Introduction

Non-communicable diseases (NCDs) are one of the leading causes of death worldwide [1-3]. According to the World Health Organization, of the 56.4 million global deaths in 2015, 39.5 million (70%) were due to NCDs [4]. Currently, the burden of NCDs is growing faster than our ability to combat them because of the obesity epidemic [5-7]. In the USA, the percentage of the US national medical expenditures devoted to treating obesity-related illness in adults increased from 6.13% in 2001 to 7.91% in 2015 [8].

Several insurers and health policymakers have attempted to prevent and reduce obesity and its related illness [9-11]. However, changing obesity-related lifestyles is not easy. Thus, a new concept to conquer NCDs has been introduced and is being tested. That is, the Centers for Disease Control and Prevention (CDC) approved some digital health programs as part of the National Diabetes Prevention Programs (DPP). A key part of the National DPP is the lifestyle change program, which aims to prevent or delay type 2 diabetes [12, 13]. The CDC recognizes lifestyle change programs that meet certain standards and show that they can achieve results. These standards include following an approved curriculum, facilitation by a trained lifestyle coach, and submitting data each year to show that the program has had an impact. However, only a few wearable devices included in the programs satisfy the standard. In addition, most of them measure daily activities and self-reported diet and body mass index (BMI) [14].

The smart belt was launched in 2016. It can measure and track an individual’s waist circumference, overeating habits, number of steps, and sedentary time [15]. On the basis of the collected information, the device provides the users with their daily activity score categorized into three groups: best, good, and poor. All real-time information is reflected on a smartphone application, and comparisons between daily activities and previous days’ activities are possible. However, the device includes no feedback or notification that encourages exercise or warning of overeating.
This is a preliminary study that aims to evaluate whether the waist circumference of
smart belt users decreased. Moreover, as this device has a distinct measurement approach,
which other smart devices do not have, evaluating its effectiveness is necessary.
Methods

Study population and variables

This study included smart belt users who downloaded the application on their smartphones and provided information on their weight, height, and age. The application measures the waist circumference of the subject wearing the smart belt at 30-min intervals and provides information on the waist circumference, steps, and sedentary time. Preexisting data were obtained from WELT corporation. A total of 451 male subjects were registered in the database initially, and 24 who had missing values and outliers for height, weight, and initial waist circumference were excluded (Figure 1). Consequently, data of a total of 427 users were analyzed.

The daily and weekly waist circumferences of the subjects were calculated using an average value of the waist circumference data measured every 30 min (Figure 2). The average waist circumference after the first week of wearing a smart belt and using the application was considered the baseline measurement. This study reports the waist circumference of the subjects during the first 12 weeks of using a smart belt.

Statistical Analysis

On the basis of the 427 user datasets, descriptive statistics were calculated for the users’ baseline characteristics, and follow-up waist circumference measurements were reported as mean ± standard deviation. There were losses to follow-up on wearing time; thus, the sample size decreased at 12 weeks compared to that at baseline. A paired t-test is generally performed to compare different conditions among the same subjects, and this approach has been used elsewhere in public health research [16]. In this study, a paired t-test was performed to identify the change in waist circumference between the baseline and each follow-up week for the same subjects.

As a multivariate approach, repeated measures analysis of variance (ANOVA), which was used to distinguish the influence of time on waist circumference change [17], was used to identify the change in waist circumference by considering time intervals. For
robustness, we used the following time intervals: 1 week, 2 weeks, and 4 weeks. Although this method extracts the contribution of subjects from the error term, some subjects were excluded from the entire analysis if the values for even one-time point were missing. In addition, the percentage of missing values in our data was not lower over time. A linear mixed model analysis, which incorporates all subjects’ waist circumference data at each time point, was conducted. A linear mixed model was used to identify the trend of the findings of previous public health studies by Xu (2003)[18], De Onis et al. (2004)[19], and Brodersen et al. (2007)[20]. The following models were considered: using only week time (model 1), week time and BMI (model 2), and adjusted time and baseline variables (model 3). Model 3 consisted of covariates from model 2 as well as age and wearing time (days) as an adjustment and attachment, respectively. Furthermore, based on the duration of continuous smart belt use, the users were divided into three groups: initial only (used the belt in the first week), passive users (used the belt between 2 and 5 weeks), and active users (used the belt for >5 weeks). ANOVA was used to compare the demographic characteristics and initial waist circumference of the three groups. Significance tests were two-sided, with the significance level set at .05. Multiple comparison problems were not considered because this was an observational study, and our purpose was to identify the trend in waist circumference change in subjects who wore the smart belt. All statistical analyses were performed using SAS 9.4 software (SAS Institute Inc., Cary, NC, USA).
Results

Table 1 shows the descriptive characteristics of smart belt users. On the basis of the demographics, the population could be representative of Korean, middle-aged, male, obese office workers. The average age, BMI, and weight were 42.29±11.83 years, 25.89 kg/m$^2$, and 79.8 kg, respectively. These values show that the users were either overweight or obese. In addition, the average waist circumference decreased continuously at 0.062 inches every week from baseline to the last follow-up week (Figure 3).

The waist circumference decreased at all time points (all weeks) compared with the baseline measurements, and most differences were statistically significant (Figure 4). Although each paired t-test had a different sample size because of the loss to follow-up, the differences between the baseline value and the value at each subsequent week until the last follow-up week increased (Figure 4).

Additionally, the waist circumference change was analyzed using repeated measures ANOVA. We considered three models with different time intervals (Table 2). Although each model had a different sample size because of loss to follow-up, all three models showed a significant difference in waist circumference change, with the average waist circumference decreasing.

Repeated measures ANOVA can be used to determine the change in waist circumference; however, in this study, only the of data users with complete information on the measuring points, i.e., 4, 8, and 12 weeks, were included. Thus, an additional analysis that incorporates all of the observed waist circumferences to identify waist circumference reduction was necessary. Table 3 shows the results of the linear mixed model using all datasets. The results show the decrease in waist circumference regardless of adjustments.

We also investigated subjects who used the smart belt for as long as possible. Here, ANOVA was used to compare the following three groups in order to investigate the difference in characteristics: initial only, passive users, and active users (Supplementary Table 1). Although no statistically significant differences in BMI and waist circumference at
baseline were observed, a statistically significant difference in age was found. The group of active users was older than the other groups, which could be because the active users tended to wear the belt for longer because of their concern regarding their health.
Discussion
On the basis of the results of our study, waist circumference tended to reduce among
smart belt users. In the paired t-test analysis, the waist circumference was reduced among
those who wore the smart belt for a longer duration. The same trend was also found using the
linear mixed models. A statistically significant reduction in waist circumference was observed
after each week of device use.
The recent Patient Protection and Affordable Care Act has incentivized physical
activity counseling by primary care physicians, which may increasingly affect not only
physicians but also health insurers and accountable care organizations. Therefore, evaluating
the efficiency of newly developed wearable smart health devices and determining how these
devices improve health outcomes are necessary.
Various insurers and health-related companies are tapping into wearable technology
for their customers to stay in shape and offer their customers wellness discounts and other
benefits if they meet a required number of fitness goals [15, 21-23]. For example, health
insurance start-up provider Oscar provides their customers with a Misfit fitness band to track
their physical movements and day-to-day activities and even monitors the users’ sleep; based
on the data, customers are rewarded once they meet their fitness goals [22]. UnitedHealthcare
and Fitbit reward users with up to $1500 US for activities completed using their device [21].
Since they can track their enrollees’ physical activity and monitor their diet, they can provide
appropriate feedback through wellness programs. Optimal Health’s program differs slightly
with the incentives because the total reward is paid out incrementally as the participants
complete each of the four steps in the challenge, which includes personal health assessment
questionnaire, tracking own nutrition, wearing of their devices and physical activity, and
downloading the application [24]. Another major health insurance provider, Humana, also
provides a 10% annual premium discount to their members if they use fitness tracking
deVICES [24].
With the numerous benefits provided by health insurers to those willing to reduce their body weight using the wearable devices, several types of research have been conducted to evaluate the effectiveness and efficiency of these smart devices [25]. Cadmus-Bertram et al. performed randomized trials of a Fitbit-based physical activity intervention in 51 inactive, postmenopausal women with BMI >25.0 kg/m² for 16 weeks [25]. Fitbit devices and application-based weight control services were provided to 21 participants in the treatment group, whereas the control group used simple pedometers. The participants were encouraged to perform physical activity. The treatment group showed a significant improvement in moderate to vigorous physical activities at 16 weeks compared to those at baseline. However, no statistically significant difference in physical activity between the treatment and control groups was observed.

Jakicic et al. [26] compared a standard behavioral weight loss intervention (n=233) and a technology-enhanced weight loss intervention (n=237). The technology-enhanced weight loss intervention group was equipped with commercially available wearable devices, which included web interface technology. No significant difference between the two groups at 24 months was observed. In these well-designed randomized controlled trials, no significant reduction in body weight between the group using smart devices and the control group was observed.

According to a systematic review of 22 studies comprising 16,476 and 14,475 subjects in the intervention and control groups, respectively [27], web-based physical activity interventions had a significantly positive effect on increasing physical activity and daily walking steps among the general population at the initial stage. However, the effect appears to depend on the design of the study, age of the participants, and duration of the study.

Furthermore, although controversies regarding the effectiveness and efficiency of smart health devices still exist, we believe that our results provide scientific evidence for the
effectiveness of the smart belt. Most of the subjects in our study were obese (BMI >25 kg/m²), middle-aged males in Korea. Korea has the second longest working hours according to the Organization for Economic Co-operation and Development (OECD); on average, Koreans work 393 hours more per year than do their counterparts in the OECD [28]. Their length of working hours is approximately 1.6 times that of Dutch workers. Thus, exercising regularly is not easy for Korean middle-aged workers. As they may need to check their daily activities and increase them, they would most likely purchase a smart belt for themselves or receive it as a gift from someone, which in turn provides motivation to lose weight. We could assume that this motivation may be greater in more obese users. Moreover, on the basis of our baseline results, active users who continue to use a smart belt for >5 weeks are older than other users. Older people might have more medical conditions and therefore more interest in their health status, which may explain the high retention of the smart belt in this age group. However, we still had a fundamental question on the reduction in waist circumference without specific intervention in this study. We carefully speculated that wearing a smart belt device has a tremendous effect on one’s positive health behaviors, as previously mentioned. Choi et al. investigated a 12-week mobile health (mHealth) physical activity intervention for feasibility and potential efficacy [29]. Thirty pregnant women were randomized to either the intervention (mobile phone application plus digital intervention program) or control (digital intervention program alone) group. The difference in weekly mean steps per day was not statistically significant between the groups, which could be because the active control condition, which includes the use of a wearable activity monitor and final goal steps that are similar to those in the intervention group, may itself have had substantial effects. Thus, wearing a smart belt possibly motivates users to reduce their waist circumference.
Although we did not include the results for the number of steps taken in this study, the average steps per hour while wearing the device statistically significantly increased compared with baseline.

This study has several limitations. First, we could not collect data from the control group. Hence, we had to include the subjects who had never worn smart belts before. Second, some important variables may have been omitted (for example, regular exercise hours or health conditions that may affect daily activity). In this study, we used only the data collected from the wearable device and self-reported data. Therefore, future studies using direct measurement data from subjects are necessary. Third, the retention rate is low. In our study, the follow-up status of the subjects depends on their usage of the smart belt. Our results may be applied mainly to active smart belt users. Fourth, we have to be careful in reverse causation. The relative long-term smart belt users may have higher unmeasured motivation to reduce waist circumference. Thus, a comprehensive measurement of the motivation to decrease waist circumference is a potential strength in future studies. Hence, further randomized controlled trials with a sufficient number of participants in which the frequency of application/device use, which represents eagerness to use the device", is adjusted for each user are warranted.

Nevertheless, our study also has strengths compared with previous research. First, we validated the effect of a new smart wearable device. To our knowledge, this is the first study to report about smart belt and its effectiveness. Second, the number of subjects in our study is 427, which is relatively higher than that in other studies on trackable and wearable devices. Third, the smart belt could be used daily by male workers in Korea; hence, its effect could be greater than that of other wearable devices.
A smart belt is a newly developed wearable device that measures real-time steps, sedentary time, and waist circumference. In our study, the smart belt helped users significantly reduce their waist circumference after 12 weeks. Since this direct-to-consumer smart health device may contribute toward reducing the risk for NCDs and controlling the increasing health cost for health insurers, a randomized control trial is necessary to further measure its effectiveness.
Acknowledgment
WELT Corporation provided the de-identified life-logs of the users of the device and application. However, the corporation was not involved in analyzing the data and in the writing of the manuscript.

Conflicts of interest
This research was supported by National IT Industry Promotion Agency (NIPA) grant funded by the Korean government (MSIT: Ministry of Science & ICT) in 2017 (NIPA -C0601-17-1008, Healthcare Wearable Smart Belt).

Abbreviations
NCD: noncommunicable disease
ANOVA: analysis of variance
CDC: Centers for Disease Control and Prevention
DPP: Diabetes Prevention Programs
BMI: body mass index
OECD: Organization for Economic Co-operation and Development
References


11. Facts F, editor National Center for Chronic Disease Prevention and Health Promotion: CDC.


18. UnitedHealthcare and Fitbit to pay users up to $1,500 to use devices, Fitbit co-founder says. CNBC 2017 Jan 5.


**Tables and Figures**

**Table 1.** Descriptive Statistics of participants*

<table>
<thead>
<tr>
<th></th>
<th>All (N=427)</th>
<th>till 4 weeks (N=223)</th>
<th>till 8 weeks (N=81)</th>
<th>till 12 weeks (N=27)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age(years)</strong></td>
<td>42.29 ± 1.83</td>
<td>44.45 ± 12.35</td>
<td>45.17 ± 12.62</td>
<td>43.11 ± 12.97</td>
</tr>
<tr>
<td><strong>Weight(kg)</strong></td>
<td>79.80 ± 2.86</td>
<td>79.65 ± 12.72</td>
<td>78.65 ± 13.06</td>
<td>75.07 ± 12.19</td>
</tr>
<tr>
<td><strong>Height(cm)</strong></td>
<td>175.37 ± 7.45</td>
<td>174.93 ± 7.37</td>
<td>175.25 ± 8.09</td>
<td>172.19 ± 7.03</td>
</tr>
<tr>
<td><strong>BMI(kg/ m²)</strong></td>
<td>25.89 ± 3.47</td>
<td>25.96 ± 3.38</td>
<td>25.54 ± 3.48</td>
<td>25.25 ± 3.40</td>
</tr>
<tr>
<td><strong>Waist(inch)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week1 (N=427)</td>
<td>35.29 ± 3.56</td>
<td>35.19 ± 3.46</td>
<td>35.20 ± 3.43</td>
<td>35.35 ± 2.87</td>
</tr>
<tr>
<td>Week2 (N=303)</td>
<td>35.22 ± 3.62</td>
<td>35.23 ± 3.52</td>
<td>35.22 ± 3.41</td>
<td>35.30 ± 3.13</td>
</tr>
<tr>
<td>Week3 (N=276)</td>
<td>35.23 ± 3.56</td>
<td>35.15 ± 3.54</td>
<td>35.16 ± 3.40</td>
<td>35.21 ± 3.10</td>
</tr>
<tr>
<td>Week4 (N=239)</td>
<td>35.21 ± 3.56</td>
<td>35.13 ± 3.56</td>
<td>35.11 ± 3.45</td>
<td>35.23 ± 3.06</td>
</tr>
<tr>
<td>Week5 (N=195)</td>
<td>35.12 ± 3.57</td>
<td></td>
<td>34.98 ± 3.58</td>
<td>35.13 ± 3.08</td>
</tr>
<tr>
<td>Week6 (N=165)</td>
<td>35.24 ± 3.43</td>
<td>35.12 ± 3.43</td>
<td>35.05 ± 3.13</td>
<td></td>
</tr>
<tr>
<td>Week7 (N=146)</td>
<td>35.41 ± 3.28</td>
<td>34.90 ± 3.51</td>
<td>34.59 ± 3.45</td>
<td></td>
</tr>
<tr>
<td>Week8 (N=134)</td>
<td>35.03 ± 3.63</td>
<td>34.79 ± 3.62</td>
<td>34.47 ± 3.60</td>
<td></td>
</tr>
<tr>
<td>Week9 (N=103)</td>
<td>34.60 ± 3.53</td>
<td>34.49 ± 3.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week10 (N=94)</td>
<td>34.93 ± 3.47</td>
<td>34.44 ± 3.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week11 (N=74)</td>
<td>34.46 ± 3.87</td>
<td>34.29 ± 3.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week12 (N=55)</td>
<td>34.77 ± 3.65</td>
<td>34.21 ± 3.81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Except for waist circumference, other characteristics including age, weight, height, and Body Mass Index (BMI) are self-reported at the baseline, when the user started their application at first.
Table 2. The differences in waist circumference using Repeated ANOVA*

<table>
<thead>
<tr>
<th>Difference from the baseline</th>
<th>Mean ± SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Week 1, 2, 3, 4 (N=215)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd week</td>
<td>-0.062 ± 0.496</td>
<td></td>
</tr>
<tr>
<td>3rd week</td>
<td>-0.100 ± 0.537</td>
<td>0.019</td>
</tr>
<tr>
<td>4th week</td>
<td>-0.128 ± 0.715</td>
<td></td>
</tr>
<tr>
<td>(B) Week 1, 2, 4, 8 (N=111)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd week</td>
<td>-0.105 ± 0.456</td>
<td></td>
</tr>
<tr>
<td>4th week</td>
<td>-0.166 ± 0.659</td>
<td>0.003</td>
</tr>
<tr>
<td>8th week</td>
<td>-0.290 ± 1.134</td>
<td></td>
</tr>
<tr>
<td>(C) Week 1, 4, 8, 12 (N=41)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th week</td>
<td>-0.068 ± 0.552</td>
<td></td>
</tr>
<tr>
<td>8th week</td>
<td>-0.300 ± 1.411</td>
<td>0.033</td>
</tr>
<tr>
<td>12th week</td>
<td>-0.565 ± 1.749</td>
<td></td>
</tr>
</tbody>
</table>

*Note that each model has different sample size due to a loss of follow-up.

Additionally, we analyzed the change of waist through repeated ANOVA. We considered three models which have different time intervals (Table 2). Note that each model has different sample size because they have a loss of follow-up. However, commonly all of three models represent statistical significance for change of waist and it is interpreted that their waist is decreasing in average.
Additionally, we analyzed the change of waist through repeated ANOVA. We considered three models which have different time intervals. Note that each model has different sample size because they have a loss of follow-up. However, commonly all of three models represent statistical significance for change of waist and it is interpreted that their waist is averagely decreasing.

### Table 3. Adjusted models for waist circumference using Mixed model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>p-value</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>p-value</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>35.409</td>
<td>0.174</td>
<td>&lt;.0001</td>
<td>25.316</td>
<td>1.188</td>
<td>&lt;.0001</td>
<td>24.983</td>
<td>1.331</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Week</td>
<td>-0.056</td>
<td>0.010</td>
<td>&lt;.0001</td>
<td>-0.055</td>
<td>0.010</td>
<td>&lt;.0001</td>
<td>-0.056</td>
<td>0.010</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>BMI</td>
<td>0.390</td>
<td>0.045</td>
<td>&lt;.0001</td>
<td>0.393</td>
<td>0.046</td>
<td>&lt;.0001</td>
<td>0.002</td>
<td>0.014</td>
<td>0.867</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>0.003</td>
<td>0.004</td>
<td>0.387</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We obtained the pre-existing data from the WELT cooperation. In the database, 504 subjects were registered initially and we excluded 77 cases who are female, missing value in the data, and outliers in height, weight, and initial waist circumference. Finally, we obtained total number of 427 users’ data.
Figure 2. Calculating daily and weekly waist circumference.

We calculated average waist circumference daily and weekly, both. The first week is a baseline measure, which was obtained when subjects had started to wear smart belt and use the applications in smartphone.
Figure 3. Trend of waist by week.

Their waists averagely decrease 0.062 inches every week from baseline to last followed-up week continuously.
Figure 4. Reduction in waist circumferences using paired t-test.

Compared to baseline waist circumferences, all of weeks show the decrease of waist and most of them are statistically significant about the difference. Even though each paired t-test has different sample size because of the intermittent loss of follow-up, the differences between baseline and each week are increasing to last follow-up week.
**Supplementary Table 1.** Comparing the baseline characteristics among three groups (Mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial only (N=101)</th>
<th>Passive user (N=126)</th>
<th>Active user (N=200)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>38.68 ± 10.73</td>
<td>41.36 ± 10.55</td>
<td>44.72 ± 12.60</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>25.89 ± 3.83</td>
<td>25.98 ± 3.61</td>
<td>25.83 ± 3.21</td>
<td>0.9338</td>
</tr>
<tr>
<td><strong>Follow up (Day)</strong></td>
<td>11.22 ± 38.54</td>
<td>20.94 ± 8.23</td>
<td>74.90 ± 34.10</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Waist circumference</strong></td>
<td>35.18 ± 3.96</td>
<td>35.29 ± 3.54</td>
<td>35.35 ± 3.37</td>
<td>0.9332</td>
</tr>
<tr>
<td>(inches, at baseline)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
References


11. Facts F, editor. National Center for Chronic Disease Prevention and Health Promotion. CDC.


17. Winer BJ. Multifactor experiments having repeated measures on the same elements.


21. UnitedHealthcare and Fitbit to pay users up to $1,500 to use devices, Fitbit co-founder says. CNBC. 2017 Jan 5.

22. Bertoni S. Oscar Health Using Misfit Wearables To Reward Fit Customers.

30