Author's response to reviews

**Title:** Using Pedometers to Increase Physical Activity in Overweight and Obese Women: A Pilot Study

**Authors:**

- Sebely Pal (s.pal@curtin.edu.au)
- cheryl cheng (c.chengl@curtin.edu.au)
- Garry Egger (eggergi@ozemail.com.au)
- colin binns (cbinns@curtin.edu.au)
- robert donovan (r.donovan@curtin.edu.au)

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**Author's response to reviews:** see over
Dear Sir/Madam,

Re: BMC Public Health- 2600572026571093 Decision Letter

Regarding your email on June 23rd, 2009, the journal paper has been revised. Each of the reviewer’s comments have been addressed individually in the section below. Each point provides a brief description of the changes made in the text in accordance with the reviewer’s comments, as well as the page and line number where these changes can be located in the manuscript.

If there are any further comments, please do not hesitate to contact me.

Regards,

A.Professor Sebely Pal
Reviewer: Nanette Mutrie

1. **Comment by Reviewer:** Suggest change ‘subjects’ to participants throughout.

**My Response:** We have changed ‘subjects’ to ‘participants’ throughout the manuscript as requested.

2. **Comment by Reviewer:** It is not clear how the control group could record ‘weekly’ steps without also seeing daily steps. I do not know of any pedometer that would allow this. How do you know this group complied with the instruction to seal them again?

**My Response:** The pedometer was sealed with tape so that the number of steps/day was concealed. This seal was only broken once per week by the participant so that the total weekly steps could be recorded and then the pedometer reset and resealed. We believe that the participants resealed the pedometers with tape as instructed for a number of reasons:
1) All were given instructions in the beginning of the study to only record weekly steps and the importance of adhering to the instructions.
2) They all signed a form to acknowledge that they understood these instructions and would abide by them.
3) We asked the participants at the assessment points whether they had adhered to the instructions.
4) Groups did not know whether they were in the control or pedometer group.

General comment: In any study, when participants are asked to take a supplement or adhere to a treatment, we have to assume that they will follow instructions or else it would be impossible to conduct any human trial. We have to rely on the honesty of the participants.

We have changed the text in the methods section (page 6, Line 17) to clarify this point as follows: “The pedometer was sealed with tape so that the number of steps/day was concealed. This seal was only broken once per week by the participant so that the total weekly steps could be recorded by them on a calendar provided. They were then asked to reset the pedometer to zero each week and seal the pedometer with tape. Participants signed a form to acknowledge that they understood these instructions and would abide by them”.

3) **Comment by Reviewer:** Discussion Line 17: Clarify if you are referring to your own study here or the cited meta-analysis since this is a different percentage increase than you have already reported- “In this study, pedometer users increased their number of steps by 27% over baseline.”

**My Response:** This statement is not in associated with the results of our current study, but in reference to the meta-analysis by Bravata et al, therefore we have modified the sentence and inserted a reference number to clarify. The sentence now reads (page 11, line 11): In the meta-analysis study, pedometer users increased their number of steps by 27% over baseline [19].

4) **Comment by Reviewer:** Discuss why you did not observe changes in any of anthropometric measures. This manuscript may provide additional insight (Gray SR et al., 2009)
**My Response:** We have added a discussion point in the manuscript as advised and referenced the work of Gray SR et al., 2009. Paragraph Inserted in manuscript (page 12, line 1): We did not observe any changes in anthropometric measures in this study, which is consistent with other studies [29]. It has been suggested that 60 to 90 min of moderate intensity exercise on most days of the week would be required for weight loss [30]. Therefore, the extra 3461 steps(steps/day (equivalent to 30 min of physical activity) performed by the pedometer group may not have been adequate to see changes in anthropometric measures in this group [31]. Anthropometric measure may have remained stable, despite increased physical activity, due to nutritional compensation. However, we did not observe any increase in dietary intake at 12 weeks (Table 3). Lack of change in nutritional intake may be due to under reporting by overweight and obese groups as shown in previous studies [32, 33].

5) **Comment by Reviewer:** The introduction is concise and provides a clear rationale for the need to establish methods of motivating overweight adults to be more physically active. However, an area that should be included is the recommendation that overweight adults should accumulate at least 60 minutes of activity on most days of the week (Physical Activity Guidelines Advisory Committee, 2008). This should strengthen the rationale for establishing new ways to achieve this higher target. This element of the introduction will also allow discussion of these targets in the discussion section.

**My Response:** We have now included this new recommendation for overweight adults in the introduction (page 3, line 17) and discussed this point further in the discussion section of the manuscript (page 12, line 13) as advised. We referenced the report by the Physical Activity Guidelines Advisory Committee, 2008.

Paragraph Inserted in manuscript introduction (page 3, line 17): “However, the 2008 US Physical Activity Guidelines Advisory Committee recommends that overweight/obese adults should accumulate at least 60 minutes of activity on most days of the week (Physical Activity Guidelines Advisory Committee, 2008). Ensuring that a sufficient amount of physical activity has been accumulated daily to attain health benefits can be very difficult, especially in the overweight and obese. Therefore, establishing new ways to achieve these higher targets need to be explored”.

Paragraph inserted in manuscript discussion (page 12, line 13): “However, new recommendations by the US Physical Activity Guidelines Advisory Committee suggests that overweight/obese adults should accumulate at least 60 minutes of activity on most days of the week for weight loss [16]. Brisk walking for 60 minutes is equivalent to approximately 6,000 steps [34]. This means that overweight individuals would need to accumulate an extra 6000 steps for weight loss. Therefore, new ways are required to help achieve this higher target. In our study, sedentary overweight and obese women were asked to comply with the National Australian guidelines for adults and increase their physical activity by 30 min/day. Those in the pedometer group with 6242 ± 541 steps/day at baseline, reached an average of 9703 ± 921 steps/day after 12 weeks, an increase of more than 3000 steps/day. However, overweight adults in our study would need to accumulate at least 12,000 steps per day to comply with these new guidelines and achieve weight loss. As suggested by the US Physical Activity Guidelines Advisory Committee, energy intake (diet) must be also be considered for weight control by this particular group [16]”. 
6) **Comment by Reviewer:** The introduction should provide some rationale for the need to target women more than men [perhaps remove this from methods].

**My Response:** We have moved the following paragraph from methods and inserted into introduction (Page 4, line 22) as suggested: “In this study middle-aged women were targeted as > 50% of this group are overweight and therefore at high risk for developing cardiovascular disease, diabetes and hypertension [2]. Women are specifically targeted in this pilot study as they generally have a large input into their families. Thus, any lifestyle changes have the potential to flow on and affect their family members (spouses, children”).

**Comment by Reviewer:** In addition, a short rationale for why feedback from step counts might prompt behaviour change – perhaps a reference to the power of self-regulation/self-monitoring or other areas in which this as been a successful strategy?

**My Response:** We have inserted the following paragraph inserted into introduction (Page 4, line 6) as suggested: “Feedback from pedometer step counts has been shown to prompt behaviour change as they raise awareness of current walking behaviours [20], can be used to motivate [21], and to self-monitor [20, 21]”.

7) **Comment by Reviewer:** Provide more details of the statistical tests.

**My Response:** More detail to statistical analysis is now provided (page 8, line 14) in methods section and under Tables and Figures to describe between group comparisons and within group comparisons.

- We have inserted the following paragraph into methods section (page 8, line 14) “Statistical analysis was conducted using SPSS 13 for Windows (SPSS Inc., Chicago, IL). Data are expressed as mean (SEM) and assessed for normality. Comparison of baseline characteristics between each group was undertaken by one way analysis of variance. Differences within groups were determined using a two-sided paired t-test. Using one-way analysis of covariance with the baseline data as the covariate, differences between groups at week 6 and 12 were conducted. Statistical differences were analysed further by post-hoc analysis using the Least Square Differences (LSD) method. Statistical significance was considered at p <0.05.”

- We have inserted the following paragraph into Results section (page 10, line 2): There was no significant differences within groups or between groups in waist, BMI, waist/hip ratio, HR or % body fat at 12 weeks. Systolic blood pressure decreased significantly by 4.7% at week 12 compared with baseline in the pedometer group (p = 0.018). The pedometer group was found to have a significantly lower systolic blood pressure (112.8 ± 2.44 mm Hg) at 12 weeks compared to the control group (117.3 ± 2.03 mm Hg) (p = 0.003). There were no significant changes to diastolic blood pressure (baseline versus 12 weeks) or between groups at 12 weeks.

- Please find detailed description under Table 2 inserted, Page (24) as follows:
Values are represented as mean ± s.e.m. 

P-values represent the between group comparison of the control vs pedometer group at week 12.

There were no significant differences at baseline between groups.

*Significant difference (P < 0.05) within group (Baseline versus 12 weeks)

Significant difference (P < 0.05) between control group and pedometer group at 12 weeks is indicated by different letters.

- Please find detailed description under Table 3 inserted, Page (25) as follows:
  Values are represented as mean ± s.e.m. 
  P-values represent the between group comparison of the control vs pedometer group at week 12.
  There were no significant differences at baseline between groups.
  There were no significant differences between groups at 12 weeks.
  There were no significant within group differences.

- Please find detailed description under Table 4 inserted, Page (26) as follows:
  Values are represented as mean ± s.e.m. 
  P-values represent the between group comparison of the control vs pedometer group at week 12.
  There were no significant differences at baseline between groups.
  *Significant difference (P < 0.05) within group (Baseline versus 12 weeks)
  Significant difference (P < 0.05) between control group and pedometer group at 12 weeks is indicated by different letters.

- Figure 1 (page 22) has now been changed as follows:
  Figure 1: A star above the 6 and 12 week bars of the pedometer group has been inserted to show within group differences.

- Figure Legend has now been changed as follows (page 22):
  Figure 1 - Average number of daily steps taken at baseline, week 6 and week 12 by the control and pedometer groups.
  The average steps/day were measured at baseline, week 6 and week 12 in both groups.
  Data is expressed as means ± SEM.
  Different letters above bar graphs indicate significance at p < 0.05.
  * Significant difference (P < 0.05) within group (baseline versus 12 weeks).
  * Significant difference (P < 0.05) within group (baseline versus 12 weeks).

8) Comment by Reviewer: Discuss limitations and suggest future direction from ‘pilot’

My Response: (page 14, line 3): In this study we asked our overweight and obese participants to comply with the Australian Physical activity guidelines which advises most adults participate
in 30 minutes of moderate intensity physical activity on most days. Further work is required to demonstrate whether using pedometers on a daily basis could help the overweight and obese accumulate at least 60 minutes of activity on most days of the week, thereby meeting the new recommendations for physical activity advised for this group [16]. It is possible that changes in anthropometric measures could be observed after 12 weeks in this group with 60 min targets. One of the limitations of this study was using a pedometer without a memory chip, where only a total step count for the week was available for the control group. There is evidence to suggest that despite participants not being able to see their daily step count when wearing sealed pedometers, a certain amount of reactivity (i.e. steps are higher) occurs during the first 2-3 days of monitoring under these conditions [39]. For future studies using pedometers with a memory chip which is capable of storing daily step counts over a period of seven days could be used. Another limitation of this study was the lack of detail in how the participants chose to perform their physical activity. It is also suggested that in addition to daily activity, exercise should be performed in bouts of 10 mins and resistance exercise should be performed two times per week [15, 29]. Although those in the pedometer group reported that they had increased their walking, the duration of each walking bout is unclear. Recommendations regarding resistance training were not highlighted to the participants.

Also inserted sentence in Discussion (page 14 line 16): “A study in overweight and obese adults has shown that a piezo-electric pedometer is more accurate than a Yamax Digi-Walker in those with higher BMI [40]. This type of pedometer could be used in future studies for studying walking behaviours in overweight and obese individuals.”
1. **Comment by Reviewer:** Methods, page 6. Can the authors add further justification for their decision to use the Yamax Digi-Walker pedometer? Of concern, Crouter et al. (MSSE 2005: 37(10):1673-9) have previously reported that the spring-levered Yamax SW-200 pedometer is less accurate at counting steps in overweight and obese adults.

**My Response:** Two earlier studies by Schneider PL and Crouter SE et al (2003, 2004) have compared 13 pedometer models and found that Yamax Digi-Walker pedometer to be the one of the most accurate and suitable for research (please see references below). The newer study conducted in 2005 in which the Reviewer is referring to, he compares the accuracy of a Spring-levered pedometer Yamax Digiwalker SW-200 (SW) with a piezo-electric pedometer (New Lifestyles NL-2000) in overweight and obese adults (average BMI 32.6 kg/m²) (please see reference below). The comparison of these 2 pedometers was not conducted when this current study was conducted. He did find that the accuracy of the Yamax Digiwalker was affected by the higher BMI. In the current study, the average BMI for control and Pedometer groups was 28.60 ± 0.75 kg/m² and 29.92 ± 0.68 kg/m² respectively, considerably less than the group studied by Crouter et al (2005). Also there was no significant difference in BMI between the groups on our study so therefore any errors in measurement will be apparent in both groups.

Inserted sentence in Methods (page 6, line 9): “Two studies have compared 13 pedometer models and found that Yamax Digi-Walker SW-200 pedometer to be the one of the most accurate and suitable for research [23, 24].”.

Also inserted sentence in Discussion (page 14 line 16): “A study in overweight and obese adults has shown that a piezo-electric pedometer is more accurate than a Yamax Digi-Walker in those with higher BMI [40]. This type of pedometer could be used in future studies for studying walking behaviours in overweight and obese individuals.”

**References:**


2. **Comment by Reviewer:** Comment: Did the authors check the accuracy of the pedometer, for example by the means of a 20 step test, on each participant at the outset (Methods, page 6)?

**My Response:** Yes, the accuracy of the pedometer on each participant was checked by the means of a 20 step test at the outset. This comment is now included in the methods section (Page 6, line 11)
Please Note: For questions 3 and 4 below, please also refer to question # 2 under Reviewer: Nanette Mutrie comments”.

3. Comment by Reviewer: Methods, page 6. Can the authors clarify that the control group recorded their own steps on a weekly basis by unsealing the pedometer, recording their weekly total, and then resetting and resealing the pedometer?

My Response: The pedometer was sealed with tape so that the number of steps/day was concealed. This seal was only broken once per week by the participant so that the total weekly steps could be recorded and then the pedometer reset and resealed. We have added this comment in methods section page 6, Line 17

4. Comment by Reviewer: Comment: Methods, page 6. As a follow-on to the above point, how were the pedometers sealed? And how did the authors confirm that the control group definitely resealed their pedometer?

My Response: We believe that the participants resealed the pedometers with tape as instructed for a number of reasons:
1) All were given instructions in the beginning of the study to only record weekly steps and the importance of adhering to the instructions.
2) They all signed a form to acknowledge that they understood these instructions and would abide by them.
3) We asked the participants at the assessment points whether they had adhered to the instructions.
4) This group did not know whether they were in the control or treatment group.

We have changed the text in the methods section (page 6, Line 17) to clarify this point as follows:
“The pedometer was sealed with tape so that the number of steps/day was concealed. This seal was only broken once per week by the participant so that the total weekly steps could be recorded by them on a calendar provided. They were then asked to reset the pedometer to zero each week and seal the pedometer with tape. Participants signed a form to acknowledge that they understood these instructions and would abide by them”.

5. Comment by Reviewer: Methods, page 6. If I am correct in what I’ve said above, even though the control group wore a sealed pedometer for 12 weeks, they still received weekly feedback in terms of their step count. How can the authors be sure that the control group didn’t receive motivation, and perhaps change their activity, from this feedback?

My Response: The control group could have received motivation from observing a weekly total. However, there was no indication that this occurred as the steps/day did not increase in the control group at 6 weeks or 12 weeks (Figure 1). In addition, there was no change in walking behaviour as demonstrated in Table 4.

6. Comment by Reviewer: Comment: Methods, page 6. How can you be sure that you measured a true baseline in terms of both groups steps/day? There is evidence to suggest that despite participants not being able to see their daily step count when wearing sealed pedometers, a certain amount of reactivity (i.e. steps are higher) occurs during the first 2-3 days of monitoring under these conditions (Clemes and Parker, MSSE 2009:41, 675-681). The limitation of using a pedometer without a memory chip, whereby only a total step count for the week is available,
should be discussed in the discussion. For future studies of this kind, I’d recommend using a pedometer with a memory chip which is capable of storing daily step counts over a period of seven days.

**My Response:** Yes, it is true that daily step count when wearing sealed pedometers can be higher during the first 2-3 days of monitoring. Therefore, to collect baseline data, all thirty participants were asked to wear a sealed over a one week period so that daily steps could be averaged. We have addressed this point and inserted a section on page 14, line 10 in the discussion section as suggested by this reviewer as follows. “One of the limitations of this study was using a pedometer without a memory chip, where only a total step count for the week was available for the control group. There is evidence to suggest that despite participants not being able to see their daily step count when wearing sealed pedometers, a certain amount of reactivity (i.e. steps are higher) occurs during the first 2-3 days of monitoring under these conditions [39]. For future studies using pedometers with a memory chip which is capable of storing daily step counts over a period of seven days could be used.”

7. **Comment by Reviewer:** Methods, page 8. Can the authors explain why they measured body composition using both the Tanita scales (please also specify the model used here) and the RJL Systems BIA – 101 Body Composition Analyser? Was body composition also measured using the skin fold measurements? In the results, please specify what device the % body fat measure presented in Table 2 came from.

**My Response:** I apologise for the confusion. Weight was measured using Tanita scales and % body fat was measured using the RJL Systems BIA – 101 Body Composition Analyzer (USA). Skin fold measurements were not conducted.

Modified Sentence in methods (page 8, line 7): “Weight measurements were taken using Tanita scales ((UM-018 Digital Scales, Tanita Corporation, Tokyo, Japan) with patients dressed in light clothing without shoes. Body composition was measured using the RJL Systems BIA – 101 Body Composition Analyzer (USA).”

Inserted sentence under Table 2 (page 24, line 11): Percentage body fat was measured using the RJL Systems BIA – 101 Body Composition Analyzer.

Deleted sentence: “Arm span, triceps and biceps, skin fold thickness and mid arm circumference were measured with calipers”.

8. **Comment by Reviewer:** Results, page 10. It is mentioned in the methods section on page 8 that resting heart rate and blood pressure was measured from participants at baseline and at week 12, however no results on these measures are included in the results section. Can these results also be added to the paper, were there any changes in these measures seen over the 12 weeks in the intervention and control groups?

**My response:** Heart rate and blood pressure were measured and changes were observed. We have now included these results in Table 2 (page 24). There were no significant changes in heart
rate (within group or between groups). Significant changes (within group and between groups) in systolic blood pressure. Additions have been made in the manuscript as follows:

Sentence inserted in Abstract (page 2, line 17): However, there was a significant decrease in blood pressure in the pedometer group (112.8 ± 2.44 mm Hg) compared to the control group (117.3 ± 2.03 mm Hg) (p = 0.003).

Sentence inserted in results section (page 10, line 2): There was no significant differences within groups or between groups in waist, BMI, waist/hip ratio, HR or % body fat at 12 weeks. Systolic blood pressure decreased significantly by 4.7% at week 12 compared with baseline in the pedometer group (p = 0.018). The pedometer group was found to have a significantly lower systolic blood pressure (112.8 ± 2.44 mm Hg) at 12 weeks compared to the control group (117.3 ± 2.03 mm Hg) (p = 0.003). There were no significant changes to diastolic blood pressure (baseline versus 12 weeks) or between groups at 12 weeks.

Sentence inserted in discussion section (Page 13, Line 10): “This study showed improvements in systolic blood pressure in the pedometer group after 12 weeks compared to the control group. As dietary intake in the pedometer group at 12 weeks did not significantly change from baseline we can comment that improvements in blood pressure are most likely due to an increase in physical activity in this group and unlikely to be influenced by any changes in dietary intake. In a meta-analysis of 26 RCTs and observational studies, intervention participants, who had increased their physical activity levels, had a statistically significant decrease in systolic blood pressure of 3.8 mm Hg and diastolic blood pressure of 0.3 mm Hg [19]. This reduction in systolic blood pressure was independent of decreases in BMI. Our results are also consistent with a meta-analysis of 54 studies conducted by Whelton et al. [38] showing that aerobic exercise reduced blood pressure in both hypertensive and normotensive adults. All frequencies, intensities, and types of aerobic exercise lowered blood pressure. By highlighting the health benefits of physical activity, health professionals can use such evidence to encourage overweight and obese patients, who are frustrated by an inability to lose weight, to engage in physical activity.”

9. Comment by Reviewer: Results, page 10-11. Throughout the results the authors report differences between the intervention and control groups, in terms of pre and post intervention measures. Were any analyses conducted looking at within group differences? From looking at the data in Table 2 I’m guessing no significant differences will be found between, for example, pre and post intervention weight of the pedometer group, but it might have been good to include these analyses.

My Response: Within group differences are now indicated in Table 2 (page 24), Table 4 (page 26) and Figure 1. Please see my response for this question under “Reviewer: Nanette Mutrie comments” point number 7.

10. Comment by Reviewer: Discussion, page 12, lines 17-18. The authors state here that “In this study, pedometer users increased their number of steps by 27% over baseline. Whereas in the results (page 10, lines 17-18) it states “At week 12, the pedometer group was taking an average of 3461 steps per day more (36% increase) than at baseline.” Please clarify the correct result.
My Response: Please see my response for this question under “Reviewer: Nanette Mutrie comments” point number 3.

11. Comment by Reviewer: Comment: Discussion, pages 12-13. The main finding of the study is that the intervention group increased their activity by an average of 3461 steps/day over a 12 week period. This is an impressive increase in activity. However, rather surprisingly, no beneficial changes in this groups body weight, BMI, waist circumference and body fat appears to have occurred. How can the authors explain this given they have also shown that reported dietary intake didn’t change substantially over the 12 weeks?

My Response: Please see my response for this question under “Reviewer: Nanette Mutrie” comments point number 4.