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Senlin Chen

Xihe Zhu
Old Dominion University, x2zhu@odu.edu

Gregory J. Welk

Youngwon Kim

Jungmin Lee

See next page for additional authors

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Original article

Using Sensewear armband and diet journal to promote adolescents' energy balance knowledge and motivation

Senlin Chen [a,*], Xihe Zhu [b], Gregory J. Welk [a], Youngwon Kim [a], Jungmin Lee [a], Nathan F. Meier [a]

[a] *Department of Kinesiology, Iowa State University, 255 Forker Building, Ames, IA 50011, USA*
[b] *Department of Movement Sciences, Old Dominion University, Norfolk, VA 23529, USA*

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Abstract

Purpose: Educating adolescents about energy balance (EB) is essential for effective weight control. This study utilized the Sensewear (SWA) armband and a diet journal to promote adolescents' EB knowledge and motivation.
Methods: Ninety sixth graders were randomly assigned into the experimental group ($n = 46$) who utilized SWA and diet journal for 7 consecutive days or the control group ($n = 44$) who did not. Both groups were pre- and post-measured on EB knowledge, situational interest, and weight. The experimental group was tracked on motivation effort, energy expenditure (EE), and energy intake (EI).
Results: EB knowledge significantly increased and situational interest remained stable (except for total interest and enjoyment) over time, but these changes did not favor the experimental group. Situational interest and motivation effort were correlated with EE, EI, and/or EB.
Conclusion: Tracking EB using the SWA and diet journal is motivating but has limited efficacy in promoting adolescents' EB knowledge. Using these two tools as educational technology in conjunction with a focused, systematic, and educational approach has the potential to leverage adolescents' EB knowledge, motivation, as well as behaviors for living an energy-balanced lifestyle.

Keywords: Energy expenditure; Energy intake; Health education; Motivation and health; Physical education; Situational interest

1. Introduction

The prevalence of overweight and obesity presents a major burden to our society and it needs to be strategically addressed.[1,2] Educating people about energy balance (EB) is essential for effective weight control.[3–5] EB denotes to the balance between energy expenditure (EE) and energy intake (EI), while EB knowledge refers to the concepts, principles, and strategies related to EB as well as its behavioral outcomes.[6] Research shows that adolescents have a deficiency in EB knowledge.[4,7] This deficiency (along with other individual and environmental factors) is likely to predispose youth to lose control of their body weight.[6]

Schools have been a common venue for intervention programs targeting EE, EI or both.[8] However, few studies have examined students' underlying EB knowledge and associated motivation for adopting healthy lifestyles. The current study employed a Sensewear armband monitor (SWA, BodyMedia Inc., Pittsburgh, PA, USA) and a portable diet journal as part of a school-based program to promote EB knowledge in adolescents. Prior research shows that the SWA is efficacious to help obese adults lose weight.[9–11] However, no research has been reported on the utility of the SWA and diet journal in educating adolescents about EB in school settings.

Tracking EB on a daily basis is challenging and requires strong motivation. Three specific phases are involved in the task of tracking EB: forethought, performance, and self-reflection.[12,13] A person would gauge the value of the task before taking an action (i.e., forethought phase), monitor their EE and EI behaviors (i.e., performance phase), and then reflect

* Corresponding author.
E-mail address: slchen11@iastate.edu (S. Chen)
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upon the outcome in terms of EB (i.e., self-reflection phase). In addition, individuals are often attracted to participate in a task for its appealing features. Situational interest refers to the appealing effect of a task on an individual.[14,15] In theory, there are five determining sources for situational interest: novelty, challenge, attention demand, exploration intention, and instant enjoyment.[14] The novel task of tracking EB via SWA and diet journal is expected to generate situational interest and promote motivation on the task.

Prior research shows that the SWA and diet journal provide an accurate estimate of EB.[16] In addition, the SWA alone is efficacious in promoting weight loss among obese adults.[9–11] Using SWA and diet journal have the potential to enhance individuals' knowledge and behavior related to EB or weight management. To date, most obesity prevention related research has been focused on nutrition knowledge[17–19] or exercise knowledge,[20,21] but only a few studies have examined EB knowledge. The available research does suggest that adolescents lack the necessary relational understanding of EB knowledge,[4,7] and EB knowledge is positively associated with moderate physical activity (PA) and negatively associated with television-viewing.[4] Further, adolescents' EB knowledge is directly related to the supporting natures of home[5] and school environments.[7] Therefore, it is important to empirically evaluate EB knowledge and its potential to influence motivation for adoption of appropriate weight management behaviors.

The primary purpose of this study was to examine the effect of a week-long experiment that involved continuous tracking of EE and EI on adolescents' motivation and EB knowledge. Because EB knowledge is related to weight management, anthropometric data were also collected. The secondary purpose of the study was to examine the association between motivation (i.e., situational interest and motivation effort), EB knowledge, and energy tracking outcomes. Hypothetically, the experience of using the SWA and diet journal would exert a significant impact on EB knowledge, and that situational interest and motivation effort would be positively associated with EB knowledge and energy tracking behaviors.

2. Methods

2.1. Participants

This study was conducted in two rural middle schools in a mid-west state of the United States in 2012. Table 1 shows the demographic information of the sample. A total number of 90 sixth graders (Male: $n = 44$; Caucasian: $n = 71$; Age: mean $\pm$ SD $= 11.71 \pm 0.53$) were recruited from eight classes on a voluntary basis. The sample has BMI ranging from 12.14 to 34.80 (mean $\pm$ SD $= 21.06 \pm 4.55$), 37% of whom were overweight (i.e., 85%ile BMI for 12-year-old adolescent $= 21.11$).[22] The number of participants per physical education (PE) class varied from 5 to 16 (Median $= 11.5$). Sixth graders were chosen because they are at early adolescence, an age threshold when obesity/overweight ratio starts to surge.[1,2] In a sustainability perspective, intervention at this period is crucial for weight control and obesity prevention.

Table 1
Demographic information of the sample.

Variable	Overall ($n = 90$)		Experimental ($n = 46$)		Control ($n = 44$)	
	n	%	*n*	%	*n*	%
Gender						
Male	44	49	23	50	21	48
Female	46	51	23	50	23	52
Ethnicity						
Asian	4	4	1	2	3	7
African American	5	6	1	2	4	9
Caucasian	71	79	36	78	35	80
Hispanics	6	7	6	13	0	0
Other	4	4	2	4	2	5
BMI						
>85%ile	33	37	18	39	16	36
≤85%ile	57	63	28	61	28	64
School						
A	46	51	25	54	21	48
B	44	49	21	46	23	52

The participants were randomly assigned into the experimental group ($n = 46$) or the control group ($n = 44$; Table 1). The participants in the experimental group utilized the SWA and diet journal for 7 consecutive days. They were provided with personalized informational feedback for one time following a standardized procedure in the middle of the week. Details regarding the treatment are available in the Procedure section below. The control group did not use the two tools until the end of the study to ensure educational equality. Prior to data collection, approvals from the university Institutional Review Board and school districts were granted; Parental/guardian consents and minors' assents were secured.

2.2. Instruments

2.2.1. EB knowledge

EB knowledge was pre- and post-tested using a standardized written test. The test had eight multiple-choice questions and one open-ended question. The knowledge scope included declarative, procedural, and conditional knowledge related to EB. For example, a question that asked about the participants' declarative knowledge stated: "Which one of the following activities requires energy the most?" The choices were "a. Having lunch, b. Watching TV, c. Jumping rope (the correct answer), d. Stacking cups". The responses were graded to the answer key and the sum of correct scores was reported as the EB knowledge performance. The performance scores ranged from 0 to 8. The written test demonstrated sufficient content validity by an expert panel using the Delphi method.[23] It also showed acceptable internal consistency (Cronbach's $\alpha = 0.52$) and test–retest reliability ($r = 0.71$).

2.2.2. Motivation effort

Motivation effort was reflected by the extent to which the participants utilized the SWA and diet journal. The SWA is a sophisticated instrument that can detect subtle motions. Specifically, the SWA recorded the percentage of time and the number of days that the participants wore it on body over the

week-long experiment. In addition, the diet journal captured the number of days that the journal was utilized during the experiment. To ensure data trustfulness, a trained data analyst processed the data that were documented by the diet journal and the principal investigator verified the accuracy. The quantification of these two sources of data measured the participants' motivation effort when tracking EE and EI.

2.2.3. Situational interest

Situational interest was measured using the Situational Interest Scale (SIS).[14] The SIS consists of 24 5-point Likert type items (5 = strongly agree, 1 = strongly disagree). The responses reflected the participants' perceptions of novelty, challenge, attention demand, exploration intention, and instant enjoyment. For example, an item that measured novelty is stated: "This is a new-fashioned activity for me to do". The participants were instructed to reference the task of tracking EB as the "activity" while completing the SIS. The SIS was developed and validated using a sample of middle school students, and displayed consistently acceptable construct validity (λ ranged from 0.60 to 0.90) and internal consistency reliability (Cronbach's α ranged from 0.63 to 0.91) across several sub-samples.[14]

2.2.4. EI

EI was measured by a self-designed portable diet journal. The diet journal prompts users to enter the following information upon consumption: time of entry, type of food/drink, amount, unit, brand, and way of preparation. The researchers provided detailed instructions on how to document nutrition information. When difficulty arose in determining portion sizes, the participants were advised to use the following methods: (a) reading food or beverage labels; (b) referring to the examples provided in the diet journal; and (c) seeking help from adults or more knowledgeable others. At the end of the study, a trained data analyst entered the data from each diet journal into Nutritionist Pro (Axxya Systems™, Stafford, TX, USA), which generated EI data (in kcal). The Nutritionist Pro was selected for diet analysis because of its comprehensive database, high efficiency of the search engine in finding foods, adaptable output feature, and affordable cost.[24] The above method to measure EI was previously used and was found accurately estimating EI among a sample of overweight/obese adults.[16]

2.2.5. EE

EE was measured by the SWA. SWA is a non-invasive, wireless multi-sensor monitor worn on the left triceps using an adjustable strap. It relies on several parameters (i.e., heat flux, galvanic skin response, skin temperature, near body temperature, and motion being determined by a tri-axial accelerometer) to measure EE (in kcal), time spent in PA of various intensities (in minute), and other movement outcomes. The SWA is user-friendly and has showed sound criterion validity and test retest reliability for assessing free-living EE.[25]

2.2.6. Weight, height, body mass index (BMI), estimated EB, and actual EB

Weight was measured using a digital weight scale (Tanita HD-366; Tanita, Arlington Heights, IL, USA). The scale took measurement of weight in kilogram, which was also converted to pound and ounce. Height was measured by the Seca 213 stadiometer (Seca™, Hanover, MD, USA). The stadiometer provided measurement in centimeter. BMI was calculated to adjust natural body growth. The estimated EB was obtained by calculating the difference between EE and EI; while actual EB was obtained through a mathematical conversion from body weight. Because one pound of body fat can be deemed as 3500 kcals of energy, actual EB was computed by multiplying the weight changed (in pound and ounce) and 3500.[6]

2.3. Procedure

The data collection procedure was carried out step by step as described below. During the first school visit, class rosters were obtained from the PE and/or health teachers. Because there were a number of students per class participated in this research project, the class rosters were reduced with participants who were coded by de-identified numbers. The participants were randomly assigned by the lead author into the experimental or the control groups. Overall, each class had roughly even number of participants per group. During the second school visit, the participants were informed of their group assignment (i.e., experimental or control group). All participants were pre-measured on EB knowledge, situational interest, weight, height, and demographic variables (age, gender, ethnicity, and date of birth). During the third school visit, the experimental group was gathered and distributed with an SWA and a diet journal per participant. Instructions on how to use the two tools as well as their utility features were carefully delivered and questions were addressed immediately. The participants were informed to wear the SWA continuously for 7 days except under following circumstances: (a) taking a shower, (b) swimming, (c) playing American football and contact martial arts. They were further informed to carry the diet journal wherever they go and document immediately everything they ate or drank. During the fourth school visit (day 3 or 4 of the week), the experimental group was provided with personalized informational feedback on the ongoing usage of the SWA and diet journal. The feedback process followed a standardized procedure. Specifically, a trained data collector summoned participants one by one (experimental group only) to a gymnasium corner, then checked and conveyed to each participant the summary data: total EE, number of steps, and minutes of MVPA accumulated on the previous day. Then, the data collector checked each participant's diet journal for consistent use. Reminders were offered for participants to log the diet journal immediately upon consumption to improve recall accuracy. During the fifth school visit, all participants (both experimental and control groups) were post-measured on EB knowledge, situational interest, weight, and height. Lastly, to ensure educational equality, the control group (through personal willingness)

received the delayed treatment using the SWA and diet journal for 7 days.

2.4. Data analysis

Data analyses consisted of four steps to address the research questions. First, descriptive analyses (e.g., mean ± SD) were conducted to reveal data distribution of the variables. Second, paired t tests were operated to examine the time effect on changes in EB knowledge, situational interest, and weight. Third, two analyses of variance (ANOVA) were conducted to determine the change in situational interest and EB knowledge across condition (experimental *vs.* control) and weight status (BMI $>$ 85%ile *vs.* BMI $\leq$ 85%ile). Fourth, a bivariate correlation analysis was performed to discern the association between motivation and EB knowledge as well as energy tracking outcomes (i.e., estimated EE, EI, and EB). SPSS19.0 (IBM Corporation, Armonk, New York, USA) was employed for data analyses with a 95% confidence interval ($\alpha = 0.05$).

3. Results

3.1. Descriptive results

Table 2 shows the descriptive results of the variables before and after the experiment. Overall, the participants performed moderately on the standardized knowledge test on an 8-point scale confirming a need to promote EB knowledge at this grade level. All situational interest constructs except the perceived challenge demonstrated high mean scores (mean value >4.0 on the 5-point scale). These results indicate that the participants perceived relatively high situational interest in using (experimental group) or seeing (control group) the SWA and the diet journal, although tracking EE and EI did not appear to be a very challenging task for them. In addition, as expected, weight remained stable over the week.

Table 3 shows an obvious discrepancy between the EI and the EE for the experimental group. EE was reported to be higher than EI (mean difference = −4745.95 kcal), which led to a negative EB. This imbalance between EE and EI considerably deviated from the actual EB obtained from weight change. Further, the SWA was utilized more persistently than the diet journal. The above results indicated that the EI was under-reported compared to EE estimate.

3.2. Effect of the treatment

Table 2 also shows the inferential statistical results across time (pre- *vs.* post-) for all participants, the experimental group, and the control group. Over the week-long experiment, the participants overall significantly increased EB knowledge ($t = -2.49$, $p = 0.02$, Cohen's $d = 0.20$). However, ANOVA revealed that this increase did not favor the experimental group over the control ($p > 0.05$). The result indicates that the acquisition of EB knowledge is not attributable to the week-long experience of tracking EE and EI using the SWA and the diet journal, respectively.

As for situational interest, the perceptions of exploration, novelty, attention demand, and challenge remained stable; but total interest and perception of enjoyment decreased over the week (total interest: $t = 5.20$, $p < 0.01$, Cohen's $d = 0.50$; enjoyment: $t = 2.53$, $p < 0.01$, Cohen's $d = 0.31$). The decline in these two constructs was not statistically significant between the experimental and control groups ($p > 0.05$). The result indicates that the SWA and the diet journal were initially perceived to be situationally interesting but the adolescent users' general interest and perceived enjoyment attenuated with prolonged use. Neither EB knowledge nor situational interested differed between normal and overweight participants ($p > 0.05$).

3.3. Association between motivation and outcome variables

Table 4 illustrates the bivariate correlations coefficients among motivation (situational interest and motivation effort) and outcome variables (i.e., EB knowledge, EE, EI, and estimated EB). Situational interest and motivation effort were correlated with the outcomes variables. Specifically, perceived exploration was negatively correlated with EI ($r = -0.40$, $p < 0.05$) and EB ($r = -0.36$, $p < 0.05$). This finding indicates that the participants reported lower EI and EB (EB = EI − EE) when energy tracking was perceived worthy of more exploration. This is noteworthy since participants

Table 2
Changes over the week-long experiment (mean ± SD).

Variables	Overall ($n = 90$)		Experimental ($n = 46$)		Control ($n = 44$)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Weight (kg)	49.56 ± 13.38	49.23 ± 12.73	48.71 ± 11.51	48.83 ± 11.31	50.47 ± 15.21	49.67 ± 14.21
EB knowledge	4.84 ± 1.39	5.12 ± 1.39*	4.89 ± 1.39	5.00 ± 1.40	4.80 ± 1.41	5.25 ± 1.38**
Exploration	4.26 ± 0.63	4.18 ± 0.78**	4.25 ± 0.54	4.15 ± 0.93	4.26 ± 0.73	4.22 ± 0.60
Enjoyment	4.55 ± 0.56	4.34 ± 0.76*	4.55 ± 0.55	4.32 ± 0.86	4.54 ± 0.57	4.37 ± 0.63
Novelty	4.44 ± 0.61	4.36 ± 0.77	4.48 ± 0.53	4.27 ± 0.88	4.39 ± 0.68	4.47 ± 0.61
Attention demand	4.41 ± 0.54	4.35 ± 0.66	4.40 ± 0.44	4.34 ± 0.66	4.43 ± 0.63	4.36 ± 0.66
Challenge	2.70 ± 1.03	2.64 ± 1.08	2.64 ± 1.13	2.67 ± 1.10	2.76 ± 0.91	2.60 ± 1.08
Total interest	4.72 ± 0.47	4.44 ± 0.63**	4.72 ± 0.43	4.45 ± 0.66**	4.71 ± 0.51	4.43 ± 0.59**

Abbreviation: EB = energy balance.
* $p < 0.05$. ** $p < 0.01$, compared with intra group pre-test values.

Table 3
Descriptive information of the variables measured in the experimental group ($n = 46$) (mean ± SD).

Variables	Measurement
EI (kcal)	11,832 ± 7245.14
EE (kcal)	−16,154 ± 5838.52
Estimated EB (kcal)	−4745.95 ± 6937.26
Actual EB (kcal)	−939.35 ± 29,214.46
Difference between estimated and actual EB (kcal)	−3260.60 ± 31,471.31
% of time for the SWA	85 ± 22
Days of SWA use	6.60 ± 1.32
Days of diet journal use	5.65 ± 2.21

Abbreviations: EI = energy intake; EE = energy expenditure; EB = energy balance; SWA = Sensewear armband.

were not specifically asked to change their behavior or to try to lose weight.

The number of days of using the diet journal was positively correlated with EI ($r = 0.65$, $p < 0.01$) and estimated EB ($r = 0.43$, $p < 0.01$); and percentage of time in using the SWA was positively correlated with EE ($r = 0.71$, $p < 0.01$). These two results demonstrated that as the participants put forth more motivation effort to utilize the SWA and diet journal, they tended to demonstrate more desirable energy tracking behaviors and outcomes. The above results illustrate that motivation plays an important role in tracking EE and EI.

4. Discussion

Using an experimental design, this empirical study found that EB knowledge was moderate in both pre- and post-measurements. The results are consistent with previous research that there is a need for EB knowledge promotion in adolescence.[4,7] Although there was an increase in EB knowledge over the week, the increase did not significantly favor those in the experimental group. Thus, it is concluded that the SWA and diet journal alone were not sufficient for promoting sixth graders' EB knowledge, at least during a very short period of time of monitoring (1 week). The modest results may also be due to the limited amount of informational feedback provided to the participants. Providing additional feedback or building the results more directly into the curriculum may help in promoting adolescents' awareness of EB. Previous large-scaled educational interventions in both community-based[26] and school-based programs[21] proved to be effective in promoting children and/or adolescents' health-related knowledge. For example, Sun et al.[21] conducted a large-scaled curriculum intervention among 5717 third, fourth, and fifth grade students in 30 schools. It was found that children who experienced the innovative curriculum learned more and at a faster rate the knowledge about health-related fitness and nutrition compared to their counterparts who received a control curriculum.[21] Future intervention studies that use the SWA and diet journal to promote EB knowledge should consider incorporating the two tools into focused, coherent curriculum and instruction to reap significant treatment results.

The experience of utilizing the SWA and diet journal seemed effective in enticing and retaining the adolescents' motivation (high mean values except for total interest and perceived enjoyment) which, in turn, exerted an impact on energy tracking outcomes. The adolescents started with relatively high situational interest (mean >4 on a 5-point scale) but then gradually leveled off (especially for total interest and perceived enjoyment). More importantly, exploration intention, a particular construct of situational interest, was found to be negatively correlated with EI. This result is interesting if it is interpreted along with the fact that the adolescents utilized the SWA more persistently than the diet journal. The combined results imply that the adolescents may be more attracted to explore the features of the SWA for tracking EE than to explore the diet journal for tracking EI. Motivation researchers asserted that motivation energy can be channeled toward different directions or purposes.[27] In this current study, the adolescents' higher motivational energy (originated from situational interest) may have been devoted to using the SWA than to using the diet journal.

Motivational effort is required in all three phases (forethought, performance, and self-reflection) of self-regulatory behaviors, when engaging in a task.[12,13] The adolescents' motivation effort to track EB was found to vary from person

Table 4
Correlation matrix for motivation and outcome variables.

No.	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	% of time the SWA use	–												
2	Days of diet journal use	0.35*	–											
3	Days of SWA use	0.78**	0.53**	–										
4	Exploration	−0.11	−0.28	−0.25	–									
5	Enjoyment	−0.17	−0.19	−0.01	0.48**	–								
6	Novelty	0.05	−0.02	−0.07	0.43**	0.43**	–							
7	Attention	−0.02	−0.04	0.06	0.20	0.32**	0.19	–						
8	Challenge	0.05	0.15	0.10	0	−0.10	0.06	0.14	–					
9	Interest	−0.04	−0.16	−0.04	0.29**	0.50**	0.29**	0.35**	0	–				
10	Estimated EB	−0.31	0.43**	−0.15	−0.36*	−0.10	−0.09	−0.19	0.04	−0.16	–			
11	Total EI	0.25	0.65**	0.36*	−0.40*	−0.17	−0.23	−0.23	0.01	−0.31	0.66**	–		
12	Total EE	0.71**	0.30	0.64**	−0.08	−0.12	−0.05	−0.09	−0.06	−0.08	−0.37*	0.45**	–	
13	EB knowledge	−0.03	0.02	−0.10	−0.07	0.11	0.17	−0.17	−0.16	0.05	0.30	0.18	−0.07	–

Abbreviations: SWA = sensewear armband; EB = energy balance; EI = energy intake; EE = energy expenditure.
*$p < 0.05$; **$p < 0.01$.

to person and that higher level of motivation effort (i.e., more persistent use of the SWA and diet journal) was positively associated with EE and EI tracking outcomes. This finding illustrates the importance of encouraging adolescents to cognitively and/or meta-cognitively regulate themselves to promote desirable energy tracking behaviors.[12,13] Comparatively, the adolescents' motivation effort to track EE via the SWA was higher than that to track EI via the diet journal, which partially led to the discrepancy between EE and EI outcomes. Future research and practice should increase the appealing features of the diet journal to make it more intuitive and user-friendly. For example, as technology advances, innovative smart phone applications have emerged for users to more conveniently log one's daily nutrition. It appears to be a promising area of research to investigate whether these validated smart phone applications could replace the traditional pencil−paper diet journals in obesity prevention research.

From a sustainability perspective, equipping adolescents with EB knowledge, motivation, and behaviors could help address the obesity crisis that burdens our society.[28] As expected, this study did not show a significant weight change as a result of using the SWA and the diet journal. Unlike previous studies in obese adults that demonstrated significant weight reduction over longer period of time,[9−11] this current study, primarily due to the short duration of treatment, did not anticipate weight change in adolescents. It is acknowledged that as adolescents are still developing toward maturity, promoting knowledge and behaviors related to EB is more important than focusing on weight reduction. For most of the healthy adolescents, maintaining a physically active lifestyle and eating in moderation and variety may be more appropriate and realistic than losing weight. Future studies that intend to intervene in weight reduction among obese or overweight adolescents may have to provide treatment for a longer duration (i.e., 8 weeks or 9 months), as illustrated in previous research on adults.[9−11] Also, it is known that achieving significant weight loss in a short period of time is not possible or even recommended since weight "regain" is often observed not long after the intervention was delivered.[29]

The findings from this research should be interpreted with several limitations. First, the research sample was primarily constituted by Caucasian participants (80%). The findings are only generalizable to adolescents of similar demographic characteristics. Second, the usage of diet journal varied considerably from person to person, although clear instructions were provided by the researchers. Shown in Table 3, the SD for EI, EB, and the difference between estimated and actual EB are large. Unlike adults who utilized the diet journal consistently,[16] adolescents in this study did not find the diet journal attractive. An online tool or an App might be more engaging and promote more consistent use. Third, the treatment effect of the experiment was limited by the short duration and modest degree of informational feedback. Future research should consider increasing the treatment magnitude (e.g., 8 weeks and more frequent feedback) to elevate adolescents' motivation, knowledge, and behavior related to EB.

5. Conclusion

In summary, this study took the initiative to incorporate the SWA and diet journal into adolescents' daily life as an attempt to promote EB knowledge and motivation. EB promotion should be taken seriously in the effort to battle the obesity epidemic that burdens our societies.[28] Intentional educational intervention should target both home and school environments where adolescents spend most of their dates.[5,30] Although a great number of school-based interventions have been done to promote the behavioral outcomes of MVPA and healthy eating (Katz et al.'s[8] review), research efforts that incorporate self-monitoring tools such as the SWA and portable diet journal to promote adolescents' motivation, EB knowledge, and behaviors are limited. This present study generated evidence supporting the applicability of the SWA and diet journal in enticing motivation for tracking EB among middle school students. Participating in the research project caused minimal interruptions to regular school activities (e.g., instructional time, class participation). However, the week-long experiment demonstrated limited efficacy in promoting adolescents' EB knowledge. Schools, especially health education and physical education professionals, are encouraged to incorporate the SWA and the diet journal or their less expensive equivalents into regular curriculum and instruction. Using these two tools as educational technology in conjunction with a focused, systematic, and educational approach has the potential to enhance adolescents' EB knowledge, motivation, as well as behaviors for living an energy-balanced lifestyle. In addition, engaging parents to provide a supportive home environment where adolescents could resort to the necessary help in tracking and manipulate EB would further increase the effectiveness of educational interventions.

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