



Effect of Psychological Need-Supportive Summer Camp: FIT-Dawg Girls Summer Camp

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Abstract: Physical activity (PA) is a major factor related to obesity risk. Research has shown PA interventions among adolescents to be moderately successful in short-term but limited to longer-term. Self-determination theory (SDT) postulates that a psychological need-supportive environment (i.e. one that supports competence, autonomy, and social relatedness) is effective in maintaining volitional motivation which can lead to sustained positive behavioral changes including PA. Although research has supported the central tenets of the SDT, there is limited evidence examining whether a summer camp intervention can sustain improvements in PA motivation and behavior. Thus, this study examined the acute and 12-weeks longer-term effectiveness of a five-day psychological need-support centered summer camp on healthy weight and overweight adolescent girls' weight management behaviors. A single-group case series study with pre-, post, and 12-week follow-up-test analyses. A sample comprised 42 ($M_{age} = 11.70 \pm 1.12$) adolescent females. Exercise motivation, PA intention, and PA and dietary behaviors were measured. The findings showed a between-group effect on daily steps ($F(1, 19) = 15.83, p = .001, \eta_p^2 = .46$), moderate-to-vigorous intensity PA ($F(1, 19) = 4.58, p = .046, \eta_p^2 = .19$), energy intake ($F(1, 19) = 7.23, p = .013, \eta_p^2 = .27$), PA intention ($F(2, 18) = 6.25, p = .024, \eta_p^2 = .28$), intrinsic motivation ($F(2, 18) = 6.25, p = .024, \eta_p^2 = .28$), and amotivation ($F(2, 18) = 16.25, p < .001, \eta_p^2 = .54$). A need-supportive summer camp may be especially effective in improving PA motivation and behavior in overweight girls.

Key Words: Self-Determination, Exercise, Female, Health, Accelerometry

1. Introduction

Summer day camps are an integral part of the summer experience of American youth with summer camp experiences varying greatly in theme or objective (e.g., character building, leadership development, sports competency) [1]. In part due to an ongoing obesity epidemic, many summer day camp providers have adopted healthy physical activity (PA) and eating guidelines to improve the health of their participants [2-4]. Data suggest that during the summer time, adolescents become more sedentary and have a less healthy dietary intake (e.g., larger portion sizes and a reduced nutrient intake)

compared to the foods they eat during the school year [5-7]. Moreover, it has been documented that the increase in adolescents' body mass index (BMI) during the summer is two-fold compared to the increase during a school year, and this change is especially apparent in girls compared to boys and overweight (OW) youth compared to healthy weight (HW) peers [8]. Thus, youth summer camp programs have the potential to enhance HW management behaviors, especially in adolescent girls who are OW. Despite this potential, little to no research has been conducted to determine the longitudinal impact of

summer camps on these weight management behaviors.

Regarding influences on health behavior, self-determination theory (SDT) is a prominent theory to understand human motivation, well-being, and sustained behaviors [9, 10]. Central to SDT are three psychological needs including competence (feeling capable to perform challenging tasks), autonomy (feelings of volition and free will), and relatedness (perceptions of belonging and meaningful connections with others) [9, 10]. Based on SDT, social environments that support the satisfaction of these needs, i.e., psychological need-supportive environment, leads to optimal motivation and functioning, whereas environments that thwart these needs are antagonistic to healthy functioning. In the youth camp context, a need-supportive environment is argued to lead to adaptive motivation and sustained and internalized health behaviors, whereas a lack of need-support results in maladaptive motivation such as rejection of requested behavior and amotivation [10]. Adaptive motivation refers to intrinsic motivation (behavior due to the inherent satisfaction of the behavior and not for external contingencies) and intrinsic forms of extrinsic regulations, such as integrated (behavior is integrated with personally important values and goals) and identified regulation (behaviors due to recognized underlying values). Maladaptive motivation, on the other hand, refers to introjected regulation (behavior due to shame or guilt due to personal or outside influence), extrinsic motivation (behavior due to obtaining rewards or avoiding punishment), and amotivation (a total lack of motivation toward behavior). SDT postulates that these different forms of motivational regulations vary in the continuum based on the locus of control, from intrinsic motivation (inner control) via integrated regulation, identified regulation, introjected regulation to extrinsic motivation (external control) [10].

Experimental research in the PA context has shown that psychological need-supportive and autonomy-supportive (focusing primarily on autonomy support, not competence or relatedness support) interventions are effective in increasing

adaptive motivation [11-14], PA engagement [13, 15], PA intention and behavior [12, 14, 16], and decreasing maladaptive motivation [17, 18]. Similarly, studies have also reported a positive association between adaptive motivation and the consumption of healthy foods [19-21] and reduced calorie intake from fat and saturated fats [22], whereas maladaptive motivation has been reported to have an inverse relationship to positive weight management behaviors [20, 21]. To our knowledge, the only experimental study that has been conducted to test the effect of a psychological need-supportive intervention on dietary behaviors showed that changes in adaptive motivation were positively associated with elderly cardiovascular disease patients' adherence to an intervention designed to reduce caloric intake and increase diet quality [23].

To date, there is a lack of studies examining the effectiveness of summer camps on exercise motivation, PA, and dietary intake. Early evidence indicates that a summer camp experience can positively impact participants' BMI [24], and factors influencing weight status including PA [25], knowledge of healthy foods [26], and self-reported dietary behaviors [26]. Moreover, research has shown that need-supportive factors during summer camps targeting PA are important predictors for participants' need for autonomy, competence, and relatedness [27]. In turn, the perception of participants' need-support has been shown to lead to increased PA engagement during camp [28].

Although early evidence suggests that a psychological need-supportive summer camp could be beneficial in initiating positive change in PA and dietary behaviors, this remains incompletely characterized in the literature. This examination is especially important among adolescent girls due to the common negative changes they experience in body composition, and PA and eating behaviors during this life stage [29]. For example, research has shown that some adolescents' inability to make healthy food choices [30], in conjunction with a decrease in PA and sport participation [31, 32], can lead to unhealthy weight gain. Moreover, this increase in weight gain during this phase of life is often carried through adulthood with the increased

risk for developing chronic diseases later in life [33]. In addition, it is intuitive that OW girls may respond differently to need-supportive camp compared to HW girls but this has not been explored in the literature.

Thus, in this context, and grounded in the SDT [9, 10], the first primary aim of the study was to examine the acute effect of a five-day psychological need-support based summer camp on HW and OW adolescent girls' exercise motivation and PA intention. It was hypothesized that the intervention would increase participants' PA intention, intrinsic motivation and identified regulation (adaptive motivation) and lower introjected and external regulation and amotivation to exercise (maladaptive motivation). The second primary aim was to examine the 12-weeks longer-term effect of the camp on participants' exercise motivation, PA intention, and PA and dietary behaviors. It was hypothesized that the positive changes in exercise motivation and PA intention would be evident 12-weeks post-intervention.

In addition, it was assumed that there would be improvements in participants' PA and energy consumption, and dietary fat intake post-intervention. Specifically, it was assumed that there would be increases in participants' steps and MVPA and improved adherence to the Dietary Guidelines on energy and fat intake [34]. Finally, a secondary exploratory aim was to examine if weight status influenced the longitudinal effects of the camp on the aforementioned outcomes of interest.

2. Method

2.1 Study Design

This study was a single-group pre-post-follow-up study conducted during four weeks in June and September/October 2017. The study was approved by the Institutional Research Board of the local university.

Table 1 Sample Characteristics

| Variable list | Target Sample | |
|---|--------------------------------------|------------|
| Ethnicity % | <i>Caucasian</i> | 30.2 |
| | <i>Hispanic</i> | 18.6 |
| | <i>African American</i> | 46.5 |
| | <i>Asian</i> | 4.7 |
| | <i>Other</i> | 0 |
| BMI | | 22.23±7.05 |
| BMI% | < 85 th | 53.50 |
| | 85 th to 95 th | 16.30 |
| | > 95 th | 34.80 |
| % Meeting the 60min MVPA Recommendation ^a | | 44.90 |
| % Meeting the 10,000 Steps Recommendation ^b | | 55.81 |
| % Meeting Energy Intake | <i>Below</i> | 44.20 |
| | <i>Meets</i> | 41.80 |
| | <i>Over</i> | 14.0 |
| % Meeting 25-35% of Energy Intake ^c from Fats Recommendation | <i>Below</i> | 2.30 |
| | <i>Meets</i> | 39.50 |
| | <i>Over</i> | 58.10 |

Note. ^a PA recommendation is to engage daily in at least 60min of MVPA (U.S. Department of Health and Human Services, 2018).

^b 10,000 step recommendation is based on the recommendation by Tudor-Locke and Bassett Jr. (2004) [35].

^c Energy intake recommendation is 1,600kcal (<14-year-olds) and 1,800kcal (≥14) if participants' lifestyle is sedentary. Added 200kcal if the participant had MVPA or 400 is VPA lifestyle [36, 37]

2.2 Participants

The sample comprised 42 ($M_{age} = 11.7 \pm 1.1$ yrs; age_{range} [10, 15]; BMI% < .85th 53.5%, 85th to 95th 16.3%, and > 95th 34.8%) females from the Southeast U.S. Forty-one participants completed the five-day camp with the pre- and posttest measurements, and 22 participants were able to complete the 12-weeks follow-up measurements ($M_{age} = 12.2 \pm 0.8$ yrs; age_{range} [10, 15]; BMI% < 0.85th 54.5%, 85th to 95th 18.1%, and > 95th 27.3%) (Table 1). The camp intervention was conducted during four five-day cohorts in June, 2017.

2.3 Psychological Need-Supportive Intervention

The intervention was delivered using psychological need-supportive teaching strategies [11-14]. Two instructors, one master, and one bachelor level physical education majors, and a certified yoga teacher (exercise science major) delivered the content. Instructors completed six hours of training in need-supportive instruction. A complete manual of operations is available from 6th author per request. The daily camp ran for five weekdays from 8:30am to 4:30pm. Activities were structured on 60 min blocks, but each activity was 50 min long with a 10 min transition. Each session included warm-up, main activity, and cooldown phases. The camp consisted of following activities: *Yoga* (4 hrs) session, *Exercise Hour* session (4 hrs), *Game hour* (4 hrs), *Lifetime PAs* (9 hrs) and *Health Classroom* (5 hrs) sessions to improve campers' PA and dietary behaviors. There was also an education component to these exercise sessions. Participants learned about basic exercise training principles and to set up goals and monitor their heart rate. A detailed description of the camp activities is presented in Table 2.

During a camp week and the 12-weeks follow-up period EDMODO (www.edmodo.com), an online platform with a discussion moderator, was used to communicate with the participants. Communication during the camp week was daily with the topics evolving around scheduling and other administrative tasks (Example: "let's meet tomorrow at 8:30!") and sending positive, encouraging health

messages during the five-day camp. During the following 12 weeks, one encouraging group health message was sent every Wednesday (Example: "Hope you found time to complete your exercises for today. Have a great day").

Additionally, every Friday the research team sent a predetermined discussion topic to the campers (Example: "Do you have a snack every time you are hungry, or do you wait for the lunch or dinner"). In addition, participants were encouraged to start their own discussion topics, send photos, and be in touch with their friends and instructors. Every cohort followed the exact same procedures communicating within their own cohorts, but there were no intended inter-cohort activities.

3. Measures

3.1 Background Information

Weight status (baseline). Height (m) and weight (kg) were measured by trained research assistants, with BMI and BMI% scores calculated.

3.2 Primary Outcome Measures

PA behavior (baseline, 12-weeks follow-up). Participants' steps and MVPA were measured objectively using the ActiGraph Link wrist-worn accelerometers (ActiGraph, LLC, Fort Walton Beach, FL) [38]. Following the National Health and Nutrition Examination Survey protocol [39], participants wore the monitors on the non-dominant wrist, and the research team provided detailed verbal and written instructions on how and when to wear the monitors and a PA log to track the wear time. The accelerometers were worn for seven consecutive days. Non-wearing time was calculated as periods of more than 30 min of consecutive zero counts. At least 80% wear time was required to be included in the study. Treuth Girls Only PA intensity cut offs of 0-99 counts per minute for sedentary PA, 100 – 2999 light PA, 3000 – 5200 for moderate PA, and 5201- for vigorous PA were used [40]. *Dietary behavior (baseline, 12-weeks follow-up).* Dietary intake, including total daily energy intake, and dietary fat intake expressed relative to caloric intake, was assessed using detailed three-day food intake records.

Table 2 The Content of the Need-Supportive Camp Intervention

| Intervention Content | Yoga | Exercise Hour | Life Time PA | Art and Craft | Health Classroom | Game Hour |
|-----------------------------|---|---|--|--|---|--|
| Dose | 3 hours/week | 4 hours/week | 9 hours/week | 5 hours/week | 5 hours/week | 4 hours/week |
| PA Intensity Level | Light-to-moderate | Moderate-to-vigorous | Light-to-moderate | Sedentary-to-light | Sedentary-to-light | Moderate-to-vigorous |
| Content Description | Based on yogic stretching to increase flexibility and muscular endurance. | Exercise activities were based on the open floor gym work focusing on PA and different components of health-related fitness. Participants also learned about training principles and to set up goals and monitor their heart rate | These sessions comprised of light to moderate PAs, such as walking/jogging and badminton | Supervised time to engage in drawing and painting activities | Classroom-based educational sessions to improve campers' dietary and PA behaviors. Lessons 1 focused on S.M.A.R.T goals, lesson 2 and 3 on healthy diet and reducing saturated fat consumption, lesson 4 on training principles, and lesson 5 on Life's Simple 7 for kids by American Heart Association with focus on the importance of calcium and iron. | Games, such as tag games, performed at the gym |

The records returned were reviewed by the research staff together with the participant to ensure clarity and completeness of the food record. Three-day food intake records have been shown to have acceptable validity among this age group [41].

Self-Determined exercise motivation (baseline, post-test, 12-weeks follow-up). Exercise motivation was measured using the Behavioral Regulation in Exercise Questionnaire 2 consisting of a 16-item scale with five subscales that measured intrinsic motivation, integrated, identified, introjected, and external regulation, and amotivation [42]. For each dimension, four items were rated on a 7-point Likert scale (1 = very untrue for me to 7 = very true for me). The stem was "I do physical exercise...", and items represented possible motives to that question, reflecting the different types of motivation. Previous studies have shown this scale to be valid and reliable for examining children and adolescent motivation [42]. In this study, Cronbach's alphas for intrinsic motivation, identified and extrinsic regulation ranged between .80 and .92 indicating acceptable internal consistency. For the introjected regulation internal consistency was marginal ranging from .72 (pretests) and .68 (posttest) to .70 (follow-up).

PA intention (baseline, posttest, 12-weeks follow-up). Participant intention to be physically active were assessed with the PA Intention Scale [43]. The three items were rated on a five-point Likert scale: (1) "I plan to do PAs that make me out of breath for at least three or more times during my free time next 12 weeks," (2) "I expect to do PAs activities during my free time next 12 weeks," and "I intend to do PA that makes me out of breath for at least three or more times during my free time next 12 weeks." (1 = strongly disagree to 7 = strongly agree) The scale has been shown to have acceptable internal reliability and construct validity [43]. In this study, Cronbach's alphas were .89 (pretests), .89 (posttest), and .90 (follow-up) indicating acceptable internal consistency.

3.3 Treatment Fidelity Measures

Instructor adherence. Instructors' adherence to psychological need-supportive instructional strategies was assessed using the Perceived Environmental Supportiveness Scale [44]. This 15-

item scale with subscales for the perception of autonomy, structure, and social relatedness assessed participants' perception of camp instructors' instructional style. The stem was "My camp instructor....", and for each dimension, five items were rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). In this study, Cronbach's alphas for autonomy, structure, and social relatedness was .91, .89, and .88, respectively.

Participant adherence. Attendance was used as a marker of adherence. In addition, potential early departures, injuries, or unscheduled breaks were recorded. Participants' steps and MVPA during camp hours were objectively measured daily using the ActiGraph Link wrist-worn accelerometers following the procedures described under PA behavior measurement.

3.4 Data Analysis

Preliminary analyses of means, standard deviations, skewness, and kurtosis were conducted first for the target sample and the subsamples of the HW and OW participants. To determine measurement equivalence, statistical comparisons between participants who participated in all measurements and participants who did not participate in the follow-up tests were examined. Next, independent samples *t* tests were conducted to test between-group differences on steps, MVPA, and energy intake in response to the five-day camp.

To test acute and 12-weeks longer-term effect of the camp, repeated measures of analysis of variance analyses were conducted separately on outcome variables of interest to test the within-group variation in the target sample. As an exploratory aim and to examine the between-group variation, participant weight status was added to the models as a covariate. BMI was included in the analysis as a binary variable (HW/OW) due to our interest in comparing the effectiveness of the intervention between these two groups. OW to PA data were processed with ActiLife 6 software and dietary intake data with the Nutrition Data System for Research [45]. All data were analyzed using SPSS version 22.0 (SPSS Inc., Chicago, IL, USA, 2017) with the statistical significance set up at $p < .05$ and Cohen's *d* effect size to .2 = small, .5 = moderate, and .8 = large [46].A

sample was considered normally distributed if the skewness and kurtosis were within ± 2 [47].

4. Results

The descriptive information on the study variables is presented in Table 3. The preliminary analyses showed the data follow a normal distribution (skewness and kurtosis values ≤ 1.12). When comparing the subsamples of participants providing three waves of full data and participants with missing follow-up data, it was deemed as having acceptable measurement equivalence (all independent t test values ≤ 1.17 , $p > .05$). At the baseline, there was no statistically significant differences in steps ($t(40) = 1.21$, $p = .234$) or MVPA ($t(40) = .94$, $p = .353$) between HW and OW participants. However, OW participants had higher energy intake compared to HW participants ($t(40) = 4.12$, $p < .001$, $d = .38$).

4.1 Treatment Fidelity

Participation frequency was high, with 41 participants completing the five-day camp. Five different participants' left early with one participant leaving early twice. The study showed camp instructors to be highly need-supportive with participants' perception on structure ($M = 6.24[.87]$), autonomy ($M = 6.44[.74]$), and social relatedness ($M = 6.13[1.07]$). In addition, the study showed participants to be very active during the camp hours with no significant difference between HW and OW participants ($M_{steps} = 16,102 \pm 3,589$, $t(40) = .23$, $p = .578$; $M_{MVPA} = 378.89 \pm 81.95$ min/day, $t(40) = .17$, $p = .654$). Participant follow-up retention was low as 22 (52.3%) participants completed the 12-weeks follow-up tests.

4.2 Acute Response to the Five-Day Camp

The analysis on the target sample showed no significant intervention effect on PA intention ($F(1, 39) = 2.51$, $p = .122$), intrinsic motivation ($F(1, 39) = .89$, $p = .352$), identified regulation ($F(1, 39) = 5.31$, $p = .028$, $\eta^2 = .14$), introjected regulation ($F(1, 39) = 1.34$, $p = .255$), external regulation ($F(1, 39) = .27$, $p = .609$), or amotivation ($F(1, 39) = 2.17$, $p = .150$).

4.3 12-Weeks Longer-Term Follow-Up

There were significant improvements in participants' PA intention ($F(2, 19) = 7.80$, $p = .012$, $\eta_p^2 = .42$; estimated mean $[\Delta]M_{baseline} = 5.64$, $\Delta M_{posttest} = 5.84$, $\Delta M_{follow-up} = 5.89$), intrinsic motivation ($F(2, 19) = 5.64$, $p = .028$, $\eta_p^2 = .28$; $\Delta M_{baseline} = 6.14$, $\Delta M_{posttest} = 6.23$, $\Delta M_{follow-up} = 6.25$), identified regulation ($F(2, 19) = 5.93$, $p = .010$, $\eta_p^2 = .31$; $\Delta M_{baseline} = 6.28$, $\Delta M_{posttest} = 6.64$, $\Delta M_{follow-up} = 6.60$), and a decrease in amotivation ($F(2, 19) = 10.12$, $p < .001$, $\eta_p^2 = .31$; $\Delta M_{baseline} = 1.82$, $\Delta M_{posttest} = 1.56$, $\Delta M_{follow-up} = 1.44$) from the baseline to the 12-weeks follow-up. However, there were no effects on introjected regulation ($F(2, 19) = 1.80$, $p = .665$; $\Delta M_{baseline} = 3.39$, $\Delta M_{posttest} = 3.21$, $\Delta M_{follow-up} = 3.20$) or external regulation ($F(2, 19) = 1.15$, $p = .633$; $\Delta M_{baseline} = 3.10$, $\Delta M_{posttest} = 3.15$, $\Delta M_{follow-up} = 3.05$).

Regarding PA and dietary behaviors, at 12-weeks post camp, there were no significant within-group effects in steps ($F(1, 20) = .811$, $p = .378$; $\Delta M_{baseline} = 10,140$, $\Delta M_{follow-up} = 10,312$) or MVPA ($F(1, 20) = 2.00$, $p = .173$; $\Delta M_{baseline} = 57.69$, $\Delta M_{follow-up} = 52.46$). However, there was significant reductions in dietary fat intake ($F(1, 20) = 64.22$, $p < .001$, $\eta_p^2 = .70$; $\Delta M_{baseline} = 33.24$, $\Delta M_{follow-up} = 17.35$).

Between-group (HW/OW) intervention effects were also explored for various outcome variables of interest. There was a significant effect from baseline to 12-weeks follow-up for average daily steps ($F(1, 19) = 15.83$, $p = .001$, $\eta_p^2 = .46$), MVPA minutes ($F(1, 19) = 4.58$, $p = .046$, $\eta_p^2 = .19$), energy intake ($F(1, 19) = 7.23$, $p = .013$, $\eta_p^2 = .27$), PA intention ($F(2, 18) = 6.25$, $p = .024$, $\eta_p^2 = .28$), intrinsic motivation ($F(2, 18) = 6.25$, $p = .024$, $\eta_p^2 = .28$), and amotivation ($F(2, 18) = 16.25$, $p < .01$, $\eta_p^2 = .54$) in OW participants compared to their HW counterparts. However, there was no significant between-group effects observed for identified regulation ($F(2, 18) = .02$, $p = .801$), introjected regulation ($F(2, 18) = 3.27$, $p = .213$), or extrinsic regulation outcomes ($F(2, 18) = 1.34$, $p = .671$).

Table 3 Study Variables (Means and SDs Presented for Target and Subsamples)

| Variable list | Pre-Intervention Target Sample | | Pre-Intervention Target Sample | | 12-Weeks Follow-Up Target Sample | |
|-----------------------------------|-----------------------------------|---------------|-----------------------------------|----------|-------------------------------------|----------|
| | HW OW | HW OW | HW OW | HW OW | HW OW | HW OW |
| Steps (per day)* | 10,136(3,796) | 16,102(3,589) | 10,377(3,109) | | | |
| | 10,776(3,941) | 16,219(3,462) | 10,603(3,117) | | | |
| | 9,361(3,561) | 15,960(3,827) | 10,133(2,856) | | | |
| MVPA (min/day)* | 244.28(86.48) | 378.89(81.95) | 287.12(74.15) | | | |
| | 255.70(90.55) | 380.85(76.15) | 298.78(78.13) | | | |
| | 230.46(88.76) | 376.51(90.55) | 279.89(80.12) | | | |
| PA Intention | 5.59(1.05) | 5.85(1.002) | 5.84(.955) | | | |
| | 5.57(1.02) | 5.63(1.09) | 5.65(.989) | | | |
| | 5.31(1.16) | 6.21(.75) | 6.24(.72) | | | |
| Intrinsic Motivation | 6.09(.92) | 6.22(.93) | 6.24(.73) | | | |
| | 6.16(.88) | 6.12(1.07) | 6.10(.82) | | | |
| | 5.90(1.00) | 6.38(.65) | 6.48(.69) | | | |
| Identified Regulation | 6.21(.66) | 6.65(.61) | 6.58(.83) | | | |
| | 6.29(.56) | 6.52(.68) | 6.57(.69) | | | |
| | 6.08(.81) | 6.61(.50) | 6.56(.79) | | | |
| Introjected Regulation | 3.42(1.79) | 3.17(1.72) | 3.20(.71) | | | |
| | 3.08(1.39) | 2.92(1.62) | 3.01(.72) | | | |
| | 3.97(2.23) | 3.56(1.86) | 3.66(.68) | | | |
| Extrinsic Regulation | 3.04(1.84) | 3.20(1.63) | 3.07(.81) | | | |
| | 3.19(1.95) | 3.32(1.71) | 3.10(.72) | | | |
| | 2.81(1.70) | 3.00(1.56) | 2.99(.71) | | | |
| Amotivation | 1.85(.85) | 1.59(.84) | 1.42(.76) | | | |
| | 1.73(.72) | 1.68(.98) | 1.66(.81) | | | |
| | 2.05(1.02) | 1.43(.53) | 1.22(.59) | | | |
| Energy Intake (kcal per day) | 1,807(420) | NA | 1,897(412) | | | |
| | 1,617(413) | | 1,712(388) | | | |
| | 2,345(577) | | 1,933(433) | | | |
| Fat Intake (% of daily intake) | 35.21(6.27) | NA | 17.35(8.16) | | | |
| | 32.13(7.87) | | 15.22(7.56) | | | |
| | 45.87(9.12) | | 22.12(9.78) | | | |

Note. *Presents steps and MVPA during camp hours

5. Discussion

The aim of this study was to examine the acute and 12-weeks longer-term effect of the psychological need-support centered summer camp intervention on HW and OW adolescent girls' weight management behaviors. Our treatment fidelity analysis showed that the participants perceived the camp as highly need-supportive, and weight status did not impact participants' camp engagement. Collectively this indicates that the intervention was delivered in a need-supportive way, and the

participants were exposed to the same treatment regardless of their weight status. Preliminary results showed that both HW and OW girls had no baseline differences in PA but had a difference in energy intake such that OW girls ingested greater daily calories. Our results contradict previous studies [48] by showing that HW and OW girls had similar and relative high PA levels, with almost 50% of the girls meeting 60 min MVPA and 56% of the girls meeting 10,000 steps daily recommendation. Specifically, the study by Hubbard et al. (2016) showed that only

15% of 8-11-year-old girls from New England met the total daily PA recommendation with OW girls having less MVPA during school and out-of-school hours compared to HW girls. These findings indicate that our sample may have been comprised of participants that are more physically active compared to the general population.

With regards to the acute effects of our camp intervention, our results suggest that our camp had minimal impacts on PA intention or the different dimensions of self-determined motivation in the target sample varying in weight status. It is noteworthy, that participants' PA intention, intrinsic motivation, and identified regulation, for instance, were high with limited room for growth, and thus likely experienced a ceiling effect. In addition, this five-day camp was relatively short in duration. Although previous research has indicated that changes in self-determined motivation can be achieved in a short period of time, some research has shown that PA motivation-related changes require at least eight weeks of intervention [49].

Interestingly, although not apparent with the acute exposure to the camp, our study showed favorable increases in participants' PA intention, intrinsic motivation, identified regulation and declines in amotivation across the 12-weeks follow-up. However, there were no apparent longer-term effects on introjected regulation or external regulation. Notably, there were no changes in PA behavior either. These findings in self-determined motivation align with previous findings that have shown changes in intrinsic motivation and identified regulation to be stronger among regular exercisers compared to weaker or no changes in introjected or extrinsic regulations [49]. Regarding diet behaviors, there were intervention effects in fat intake (percentage of total energy intake declined) with no other effects being apparent. This lack of findings could be due to the age of the participants in our study. The mean age of the participants was 11.7 years ranging from 10 to 15 years, and thus adolescent girls are independent to think but dependent on the decision of their parents for many food choices. Moreover, the follow-up period was during a school week, where the participants had

little discretion over the food provided and the activities they do in and outside of school. According to Welk, Wood, & Morss (2003), role modeling and parental support promote health behaviors in children [50, 51], especially maintenance of this habit later in adolescence girls [52].

The most interesting finding of this study is that weight status influenced the development of participants' PA behaviors, PA intention, intrinsic motivation, and amotivation. Specifically, OW participants increased their steps and MVPA over the 12-weeks, whereas there were no changes in HW girls' steps or MVPA. In addition, with regards to PA intention and intrinsic motivation, OW participants' growth was greater and amotivation decline smaller compared to HW participants. To our knowledge, this study is one of the first to show that weight status may impact how adolescent girls perceive a psychological need-supportive intervention targeting weight management behaviors. Our findings support the previous findings that have shown that OW individuals have less beneficial levels of self-determined motivation [53] and that BMI correlates negatively with intrinsic exercise motivation [53]. Markedly, there were no between-group level changes in identified and introjected regulation and extrinsic regulation. This study contributes to the existing literature on showing that both end points of the motivational continuum, which are intrinsic motivation and amotivation seem to be the most sensitive to participants' weight status.

Finally, this study showed that although there were no changes in energy intake with the target sample, there were differences in how OW and HW participants' energy intake changed across the 12-weeks follow-up period. Specifically, our study showed that OW participants reduced their energy intake to be more congruent with recommendations, whereas there was no change in HW participants' energy intake. These findings are encouraging giving some indication that a short-term need-supportive intervention may help OW participants with weight management behaviors. Our findings are in accordance with the previous findings that has shown children involved in the SDT-centered intervention were more likely to choose healthy

foods and less likely to choose high-fat foods compared to children in a control group [54]. A lack of studies in STD and dietary intake in our population of interest precludes making any definitive speculations or conclusions.

6. Conclusions

Although our novel findings are of interest, this study is not without limitations. First, this study lacked a control group which prohibits making definite conclusions. Second, our sample consisted of relatively active girls which preclude extrapolation to other sedentary cohorts. Third, although we explored weight status as a secondary aim in our design, additional work would benefit from the intentional exploration of weight status on our outcomes of interest using a blocked randomized design. Finally, our study experienced high 12-week follow-up measurement attrition. To our surprise, a large portion of participants lived outside of town and were not available for follow-up testing. Our university organizes highly popular summer camps across different domains. Similar to the other camps, our camp attracted many participants from different parts of the state.

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