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Comparing Two Child Obesity Interventions to Improve Body Composition, Motivation and Well-Being: A Feasibility Study

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Abstract Regular physical activity and balanced nutrition are important in maintaining a healthy weight. Nonetheless, minority populations, like Hispanics, face challenges (e.g., language barriers and transportation unavailability) that limit their participation in intervention programs to receive benefits. Furthermore, dog companionship has been shown to relate to adolescents' behavioral and socio-emotional development positively, and it has been shown to have the potential to increase physical activity in adolescence. Therefore, this study aimed to examine the feasibility, i.e., program adaptation, limited efficacy, and acceptability, of the two exercise and nutrition education interventions to improve body composition, motivation, and well-being in overweight and obese Hispanic adolescents. This pilot study was a quasi-experimental trial with eight pediatrician-referred participants (M_{age} =11.75±1.48) assigned to two parallel arms: 1) BRAVO! and 2) BRAVO!+. Both share identical exercise (24 hours) and nutrition (12 hours) programs centered on the self-determination theory for 12 weeks. The results suggested, first, acceptable attendance (BRAVO! = 56.25%; BRAVO!+ = 64.58%) but poor retention (BRAVO! = 33.33%; BRAVO!+ = 63.63%). Second, the findings suggested promising limited efficacy in BRAVO!+ group, with small but statistically non-significant reductions in participants' BMI ($M_{baseline}$ = 33.08±6.13; M_{post} = 32.23±6.88; t[3] = 1.633, p = 0.201) and weight ($M_{baseline}$ = 78.13±16.22; M_{post} = 77.62±17.64; t[3] = 0.485, p = 0.661). In addition, the results suggested high satisfaction and acceptable suitability for both programs and providing important suggestions for the future. In conclusion, our pilot study findings only partially supported the feasibility of the pet-dog-enhanced lifestyle intervention. Although this study found evidence that pet-dog companionship can improve program satisfaction and acceptability of pediatric lifestyle interventions, including a pet-dog in the intervention may contribute to high dropout evidenced in this study.

Keywords: *weight management, weight loss, adolescence, intrinsic motivation, self-determination, canine study*

1. Introduction

The obesity epidemic is a common public health concern affecting the United States (US) (Wang et al., 2020). Chronic diseases, such as type 2 diabetes mellitus and metabolic syndrome, are known to be associated with obesity (Peirson et al., 2015). Also, it has been estimated that the economic burden of obesity in the US alone is somewhere between $147 to 210 billion per year (Cawley & Meyerhoefer, 2012; Finkelstein, 2009). Obesity is connected to general family health as there is a strong positive association between parental obesity and their children's obesity rate (McLoone & Morrison, 2014), and childhood obesity tends to transfer obesity into adulthood (Simmonds et al., 2016; Singh et al., 2008). In addition, it has been reported that Hispanic children (26.9%) and adolescents (25.6%) have the highest obesity rate of all racial/ethnic groups (Fryar et al., 2018). This is concerning as Hispanic adolescents (12-19-year-olds) are becoming one of the fastest growing pediatric obesity populations (Ogden et al., 2020). To reduce the consequences of an obesity epidemic and support people with overweight and obesity, a plethora of interventions have been designed and conducted (Ho et al., 2012). Lifestyle intervention programs, typically consisting of physical activity (PA) / exercise sessions, nutrition education, and behavior modification/therapies (Reinehr, 2013), are examples of standard obesity treatment or prevention programs. Meta-analyses have also shown that these obesity interventions produce moderate effects on body composition and weight-related outcomes (Berge & Everts, 2011; Brown et al., 2016; Ho et al., 2012). BRAVO! is an ongoing, well-established pediatric obesity treatment program, based on the basic principles of Self-Determination Theory (SDT: Deci & Ryan, 1985, 2000; Ryan & Deci, 2017) that promotes a healthier lifestyle among overweight

and obese adolescents. BRAVO! has been shown to be effective in generating positive changes in participants' body composition-related outcomes, e.g., body mass index (BMI), waist circumference, and health-related fitness-related outcomes, e.g. cardiovascular endurance, upper body muscular strength/endurance, and abdominal muscular strength/endurance with small or medium effects (Deng et al., 2024).

In addition, previous studies have shown that animal ownership is common in the US, with 40% of US households owning one or more companion dogs. Dog ownership has also demonstrated positive influences on the owner's mental and physical health (e.g., increased PA and psychological support). Furthermore, dog companionship has been shown to relate positively to adolescents' behavioral and socioemotional development (Wohlfarth et al., 2013). For example, the result from a previous study using a therapy dog indicated a positive potential to increase physical activity in obese adolescents (Wohlfarth et al., 2013); there was less passive behavior in the presence of the dog group compared to the human interaction group and higher sportive activity when the dog was present. In addition, it has been shown that child-dog attachment relates positively to PA engagement (Gadomski et al., 2017).

Grounded in the Social-Cognitive Theory (Bandura, 2012), recognizing the role of a supportive social environment on human behaviors and the evidence suggesting that dog-human companionship can lead to healthier behaviors for pet owners, the BRAVO!+ intervention was designed. BRAVO!+ is an advanced version of the previous BRAVO! lifestyle intervention program, including exercise and nutrition education. BRAVO!+ complements BRAVO! by utilizing a human-dog relationship and relying on the research findings showing the benefits of dog ownership on the efficacy of obesity treatment programs and its positive impact on fostering meaningful social connections for adolescents to enhance the efficacy of the BRAVO!. Specifically, BRAVO!+ program includes BRAVO! along with daily 20-minute dog walk/play as a recommendation for the participants.

Therefore, to provide solutions to treat obesity in Hispanic adolescents, the overarching purpose of this study was to examine the feasibility of BRAVO! and BRAVO!+ lifestyle intervention programs to improve BMI, self-determined motivation, and well-being in overweight and obese Hispanic adolescents. Specifically, the first aim was to examine program adaptation by exploring similarities and differences in participant attendance, retention, and participation indicators during these two interventions. The second aim of this study was to compare the limited efficacy of the BRAVO! and the BRAVO!+ on body composition, motivation, and subjective well-being in Hispanic adolescents with obesity. Third, the study aimed to explore the acceptability of the programs to test the extent to which the programs can be judged as suitable and satisfying for the participants.

2. Methods

2.1. Participants

This pilot study was a quasi-experiment trial with a convenience sample of 17 participants (M_{age} =12.59, SD=2.30) assigned to two parallel arms: 1) BRAVO! (2 males and 4 females) and 2) BRAVO!+ (2 males and 9 females) arms. The following eligibility criteria for the BRAVO! group were: a) 11-16 years old, b) pediatrician reported overweight or obesity, with an additional eligibility requirement for the BRAVO!+ group was a pet dog ownership. Adolescents: (a) diagnosed with a condition that influences physical activity or cognition; (b) currently (or within 6 months) enrolled in a formal weight loss program; or (c) self-reported ethnicity other than Hispanic were excluded from the study. All participants were fluent English speakers. However, a Spanish-speaking translator participated in all weekly research activities for the parents' participation in nutrition lessons and general communication between the research team and the families.

2.2. Procedures

Research representatives distributed the study flyers to local pet-friendly hotels and veterinary and pediatrician clinics during recruitment. The potential participants' parents/guardians interested in the study used the QR code attached to the flyer and completed the screening form on Qualtrics (Qualtrics, Provo, UT). Once the screening form on Qualtrics was completed and collected online, the research representative contacted the parents of potential participants who met all three eligibility criteria and invited both parents/guardians and the underage participants to the pre-testing session (week 0). An identical post-test session was conducted at week 13 immediately after the 12-week intervention.

2.3. Intervention

2.3.1. *BRAVO! Lifestyle Intervention*

The detailed description of the BRAVO! has been published previously (Deng et al., 2024), and the program manual is available on request. The intended dose of the intervention was 24 hours of fitness-based exercise training and six hours of family nutrition education. Both exercise and nutrition education sessions were held in person with two or more trained instructors and one or more graduate-level supervisors overseeing the program. Exercise sessions followed the structure, beginning with a 10-minute warm-up, 40-minute main activity, and 10-minute cool down / closure session. Exercise sessions were held two times a week (Tuesday and Thursday evenings), each lasting one hour. Nutrition education sessions were held for 30 minutes once a week on Thursday evening, followed by the Thursday exercise session.

Exercise and nutrition session objectives are presented in Table 1. For example, yoga, boxing, and martial arts themes were used for exercise sessions, whereas themes and topics such as goal setting, reducing trans/saturated fats, and food group friends were used in the nutrition sessions. Every exercise session was intended to meet one of the following benchmarks: (a) participant indicated exercise exertion as a five or six on the Borg Rating of Perceived Exertion Scale (10 range scale) and/or (b) an average heart rate during main session activity > 64% of the participants' estimated maximal heart rate.

Previously, formal BRAVO! average exercise perceived exertions have been assessed as 5.66 ±1.40 and 128.33±15.44 beats/min for average heart rate. The highest average perceived exertion was found during the Spelling Games (exercise session #11), with an exertion score of (5.58 ± 1.88), while the lowest perceived exertion was assessed during the Yoga lesson (#17; 3.50 ± 1.60). During the Spelling Games, 90% of the participants met the benchmark, and only 56% of the participants did meet the benchmark for the Yoga lesson.

Table 1. Intervention Outline

Weeks	Exercise	Nutrition
Week 1	Circuit Training I and II	Goal Setting
Week 2	Circuit Training & No-Contact Martial Arts	Food Groups Friends
Week 3	No-Contact Martial Arts & Circuit Training	MyPlate: Discovery Trail
Week 4	Circuit Training & Workout Blast	MyPlate: Eat the Colors
Week 5	Workout Bingo & Circuit Training	MyPlate: Avoid Sugary Beverages
Week 6	Circuit Training & Spelling Game	MyPlate: Be Whole Go Whole Grain
Week 7	No-Contact Boxing I & II	MyPlate: Dietary Fats, Knowing the Types
Week 8	Circuit Training & Yoga	MyPlate: Reduce Trans/Saturated Fats
Week 9	Yoga & Circuit Training	MyPlate: Rock Your Snacks
Week 10	Spelling Game & Workout Blast Break	MyPlate: Drink up Diary Daily
Week 11	Workout Bingo & Circuit Training	MyPlate: Creating a Healthy Environment
Week 12	Circuit Training & Spelling Game	Bring it All Together

Although the goal of the exercise intensity was set to moderate-to-vigorous intensity, participants had the freedom to choose their own intensity level for each exercise session. In addition, they could select the activity difficulty that directly impacted their exercise exertion (e.g., regular push-ups, knee push-ups, or wide push-ups). All participants received a BRAVO! booklet before the study. The booklet had objectives for each exercise and nutrition lesson and suggested homework (e.g., home exercise for BRAVO! and playing with a pet dog for BRAVO!+) for the off days when participants did not have the intervention sessions. The booklet also had places for them to take notes, see the visual presentations for nutrition lessons, and see the homework suggestions. The booklet for BRAVO! and BRAVO!+ groups slightly differed in the homework suggestions, while all other contents were identical.

2.3.2. *BRAVO!+ Lifestyle Intervention*

While participants in BRAVO! and BRAVO!+ participated in identical nutrition and exercise sessions together, and participants in BRAVO!+ brought their pet dogs to the intervention facilities. While the human participants participated in the BRAVO! exercise session, their pet dogs were walking a trail outside with trained dog walkers under the supervision of veterinarians or veterinary school students. Dog walking sessions were canceled when the outdoor walking became unsafe for the pet dogs or the dog walkers (e.g., lightning, heavy rain, etc.). In addition, to the exercise and nutrition lessons, BRAVO!+ participants were asked to walk or play with their pet dog for at least 20 minutes daily.

2.4. Measurement

2.4.1. *Attendance*

The program supervisors took attendance for both exercise and nutrition classes. Participants' parents were asked to attend the nutrition lessons with their child. Parents' attendance for nutrition classes was also recorded.

2.4.2. *Perceived Exertion*

Exercise exertion was measured objectively using average and maximum heart rates measured by Fitbit Inspire 2 Fitness Tracker and subjectively using participants' self-perception (perceived exertion; Borg, 1998). After the warm-up (before the main activity), participants used their Fitbit Watch to start the workout tracking function, which provided average and maximum heart rates during the workout session. After the main activity, participants brought their Fitbit Watch to the supervisors for data collection for heart rate data and verbally shared their perceived exertion number between 1 and 10 (e.g., 1 being the easiest activity and 10 being extremely difficult and tiring).

2.4.3. *Body Composition*

Body weight and height were measured in light clothing and without shoes to the nearest tenth of a pound on a digital electronic scale and the nearest tenth of an inch on a portable stadiometer for measuring height. To increase the data accuracy, both heights and weights were measured twice for each participant following the same procedure and doubled checked for identical results. Using the height and weight data, the BMI calculation formula (weight/height2 × 703) was used to find out BMI. Once the BMI was calculated for each participant, BMI-Z and BMI percentiles were determined on an online BMI score calculator (Children's Hospital of Philadelphia's Research Institute BMI Z-Score Calculator).

2.4.4. *Self-Determined Exercise Motivation*

Participants' self-determined exercise motivation was assessed with the Behavioral Regulation in Exercise Questionnaire (BREQ-3; Markland & Tobin, 2004; Wilson et al., 2006). The scale includes 24 statements representing different forms of motivation for exercise. The scale is rated by a 5-point Likert Scale (1 being not true for me and 5 being very true for me). The scale measures participants' intrinsic motivation, integrated, identified, introjected, extrinsic regulation, and amotivation. Intrinsic motivation (e.g., "because it's fun"), integrated regulation (e.g., "because it is consistent with my life goals'), identified regulation (e.g., "it is important to me"), introjected regulation (e.g., "I feel guilty when I do not"), external regulation (e.g., "because other people say I should"), and amotivation (e.g., "I do not see why I should have to participate)" are the example motivational regulations and their statements. BREQ-3 is also known for its validity (Markland & Tobin, 2004) and internal consistencies of the scales at pre- and post- tests represented as followings: amotivation (Cronbach's alpha [α] = 0.78 and 0.83), external regulation (α = 0.70 and 0.79), introjected regulation α = 0.78 and 0.83), identified regulation (one item removed; α = 0.70 and 0.75), and intrinsic motivation (α = 0.80 and 0.93).

2.4.5. *Subjective Well-being*

The Satisfaction with Life Scale-Child (SWLS-C; Diener et al., 1985) measured participants' satisfaction with their lives. Five questions (statements) were answered with a 5-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. Example statements on the SWLS-C are "The things in my life are excellent" and "I am happy with my life." The validity of this

scale has shown to be acceptable for this age group (Gadermann et al., 2010).

2.4.6. *Interviews*

After 12 weeks of intervention, individual interviews were conducted with all participants in person. The aim of these semi-structured interviews was to understand the participants' overall perceptions and beliefs about the BRAVO! and BRAVO!+ programs to inform about the suitability and satisfaction of the programs. The interview guide was designed by research team members with experience in qualitative interviewing to examine the suitability of the BRAVO! and BRAVO!+ programs and participants' satisfaction with them. All the interviews were completed during week 13 as part of the post-test protocol. Before post-assessment, interviewers were trained by members of the research team with experience in qualitative interviewing. Each participant spent approximately 20 minutes with one of the research representatives (e.g., supervisor or instructor) with whom the participants were familiar. While all interviewers asked the same set of initial questions, the semi-structured nature of the interview process allowed for follow-up questions as needed (e.g., when the answer was unclear or the answer did not provide specific examples, etc.) All interviews were recorded and transcribed using Automatic Zoom Transcript. The research team manually reviewed the transcript as they rewatched the recorded interview, correcting spelling errors or incorrect matches generated by the auto-transcription. To support participant confidentiality, research team members replaced potentially identifiable information (i.e., names, references to specific places or individuals) with pseudonyms and generic terminology during the transcript review process.

2.5. Data Analysis

The following mixed-methods data analyses were conducted. First, to test program adaptability, descriptive analyses for the "intention-to-treat-groups" and "by-treatment" were conducted using SPSS 29.0. Second, to test the limited efficacy of the programs, within- and between-group analyses using paired samples t-tests and an analysis of covariance were conducted. Finally, a qualitative deductive thematic analysis was conducted to provide detailed information about the acceptability (i.e., suitability and satisfaction) of the programs and to help understand the quantitative research findings. After transcription, interview data were thematically analyzed using NVivo software. The researchers followed a six-step thematic analysis method outlined by Clarke & Braun (2013). These steps included: 1) familiarizing oneself with the data, 2) generating codes, 3) identifying themes, 4) reviewing and refining themes, 5) defining and naming the themes, and 6) locating specific examples. The researchers read the interview transcripts to become familiar with the data and generated initial codes. Then, they examined these codes to identify themes, which were subsequently reviewed and validated to reach an agreement. Finally, the themes were named and reviewed once again, resulting in a thematic map that clearly addressed each theme. The researchers selected relevant examples from the data to effectively illustrate each theme. To ensure the trustworthiness of the qualitative research, the researchers followed the eight criteria proposed by Tracy (2010).

3. Results

3.1. Characteristics of the Sample

Table 2 presents the participants' baseline scores for all fitness, motivational regulations, and well-being measurements. Sex- and age-adjusted BMI suggested that participants were either overweight or obese (6 out of 8), and there were no statistically significant group differences in BMI. In terms of motivational or well-being variables, there were no statistically significant group differences.

3.2. Program Adaptation

3.2.1. *Program Attendance and Retention*

A sample of 32 potential participants responded to the recruitment efforts (flyer advertisements) at the local pediatrician offices, veterinary clinics, and veterinary hotels. Out of 32, 15 participants were excluded from the study due to not meeting the inclusion criteria (i.e., older age, worsening health issues, not interested in participating in the program anymore, or no responses). The remaining 17 participants ($n_{BRAVO!} = 6$; $n_{BRAVO!+} = 11$) participated in the pre-test and showed a willingness to participate in the intervention programs, the attendance rate being 56.25% and 64.58% for BRAVO! and BRAVO!+ group, respectively. However, only eight participants completed the programs. Two participants (33.33%) from the BRAVO! group terminated their participation, whereas the dropout rate for BRAVO!+ was 63.63% (7 participants). The following dropout reasons were given by the participants: a) moving to a new location and b) no particular reason.

3.2.2. *Program Participation*

As-treated exercise session attendance rates were 13.5±8.67 (56.25%) and 15.5±5.68 (64.58%), BRAVO! and BRAVO!+, respectively. The attendance rate for the nutrition lessons was for the BRAVO! 6.00±0.00 (54.54%) and BRAVO!+ 6.25±2.68 (56.81%). Lastly, the parent/guardian attendance rate for the BRAVO! was 4.25±0.43 (38.64%) and for the BRAVO!+ 4.25±2.28 (38.64%).

Table 3 presents exercise exertion scores. The participants' average perceived exertion score for the main activity was 3.52±0.96. One participant (Participant ID 8; 5.23±0.58) met the target benchmark (self-report score 5 or 6). BRAVO! participants' perceived exertion scores were 4.20±0.68, whereas BRAVO!+ scores were 2.84±0.44. An average heart rate during the main activity was 118.24±5.62 for the BRAVO! group and 123.57±14.33 for the BRAVO!+.

On the other hand, the maximum heart rates for the groups were 144.06±4.92 and 152.84±16.91, BRAVO! and BRAVO!+, respectively. The objective heart rate measurement findings showed that none of the participants met the benchmark 65% maximal heart rate.

3.2.3. *Changes to the Research Protocol*

Due to the intervention schedule conflict with a Thanksgiving holiday in Week 10, a minor change had to be made to the exercise and nutrition lessons. For the exercise lesson, the Thanksgiving Thursday class was moved to Tuesday after the Week 12 as a make-up day. For nutrition lesson, Thanksgiving Thursday lesson was combined with the week 11's lesson (the following lesson after Thanksgiving) and the participants received

Table 2. Descriptive Statistics.

Groups	Intention-to-treat BRAVO!	Intention-to-treat BRAVO!+	As-Treated BRAVO!		As-Treated BRAVO!+	
N	6	11	4		4	
Gender	M = 2 and F = 4	M = 2 and F = 9	F = 4		F = 4	
Age	13.83±3.31	11.91±1.45	11.50±1.66		12.00±1.22	
	Pre-Test	Pre-Test	Pre-Test	Post-Test*	Pre-Test	Post-Test
BMI	29.00±4.00	29.04±8.16	30.78±3.73	NA	33.08±6.13	32.23±6.88
Height (cm)	150.17±9.89	158.88±9.52	150.75±12.04	NA	154.13±4.58	154.94±5.87
Weight (kg)	65.85±15.36	73.70±23.36	70.52±17.37	NA	78.13±16.22	77.62±17.64
Intrinsic Motivation	3.42±.66	3.52±.90	3.69±.43	NA	3.00±.58	3.31±1.07
Integrated Regulation	2.95±.49	2.79±.86	2.92±=.57	NA	2.42±1.03	2.75±1.34
Identified Regulation	3.61±.57	3.88±1.01	3.67±.27	NA	3.50±.69	3.06±1.03
Introjected Regulation	2.92±1.04	2.77±1.34	3.00±1.32	NA	2.31±1.28	1.94±.77
External Regulation	2.67±1.02	2.68±1.34	3.00±.79	NA	2.69±1.57	2.00±.82
Amotivation	2.29±1.14	1.86±.74	2.44±1.42	NA	2.06±.88	2.19±.59
Well-Being	3.43±.75	3.56±.97	3.45±.72	NA	3.25±1.10	3.30±1.09

Note. N = number of participants per group, M = Male, F = Female, * = No BRAVO! Group participants participated in the posttest

Table 3. Objectively and Subjectively Measured Exercise Intensity.

ID	Age	Maximum HR (220 – Age)	65% of Maximum HR	Average Maximum HR during Main Activity	Average HR during Main Activity	Average Subjective Perceived Exertion
1	11	209	135.85	161.50	135.83	2.14
2	14	206	133.90	156.47	126.29	2.84
3	11	209	135.85	128.07	102.93	2.46
4	12	208	135.20	165.32	129.23	3.91
5	13	207	134.55	138.54	113.38	3.87
6	13	207	134.55	150.45	126.36	5.23
7	11	209	135.85	142.92	116.60	4.31
8	9	211	137.15	144.31	116.62	3.38

Note. Heart rate = HR

two-week portion of nutrition lessons in one day (Week 11). More detailed schedule is presented in Table 1. In addition, none of the four participants of the BRAVO! group participated in the post-testing.

3.3. Limited Efficacy

The descriptive statistics of the sample are presented in Table 2. Due to the absence of the BRAVO! posttest data, descriptive data on the limited efficacy is only available for the BRAVO!+ group.

3.3.1. Body Composition

For the BRAVO!+ group, the inspection of mean levels suggested positive changes in participants' BMI and weight. These differences, however, did not meet the statistical significance level: BMI ($M_{baseline}$ = 33.08±6.13; M_{post} = 32.23±6.88; t[3] = 1.633, p = 0.201) and weight ($M_{baseline}$ = 78.13±16.22; M_{post} = 77.62±17.64; t[3] = 0.485, p = 0.661).

3.3.2. *Motivational Regulations and Well-Being*

To observe the differences between pre- and posttest results in BRAVO!+ group, paired sample t-test analyses were conducted. For the BRAVO!+ group, none of the motivation regulations, including intrinsic motivation ($M_{baseline}$ = 3.00±.58; M_{post} = 3.31±1.07; t[3]=-1.000, p = 0.391, d = 0.36), integrated regulation ($M_{baseline}$ = 2.42±1.03; M_{post} = 2.75±1.34; t[3] = -1.532, p = 0.223, d = 0.28), identified motivation ($M_{baseline}$ = 3.50±0.69; M_{post} = 3.56±1.03; t[3] = 2.483, p = 0.889, d = 0.07), introjected regulation ($M_{baseline}$ = 2.31±1.28; M_{post} = 1.94±0.77; t[3] = 1.260, p = 0.297, d = 0.35), external regulation ($M_{baseline}$ = 2.69±1.57; M_{post} = 2.00±0.82; t[3] = 1.203, p = 0.315, d = 0.55), amotivation ($M_{baseline}$ =2.06±0.88; M_{post} = 2.89±0.59; t[3] = -0.225, p = 0.836, d = 1.11), and well-being ($M_{baseline}$ = 3.25±1.10; M_{post} = 3.30±1.09; t[3] = -0.136, p = 0.901, d = 0.05) had no statically significant differences.

3.4. Acceptability

Interview data analysis was conducted to examine the acceptability, that is, stability and satisfaction of the BRAVO! and BRAVO!+ programs. Qualitative results suggest that while both programs were generally acceptable, the human/dog interactions featured in the BRAVO!+ program may offer some unique additional benefits.

3.4.1. *Suitability*

Suitability of the program is important in resonating with and encouraging participants to participate in the program and accept its key objective. Participants expressed that they appreciated the choices they had during the program, Specifically, participants appreciated that they were given exercise choices during the game-based portions of the program. In general, participants described the importance of being able to select appropriate exercises and difficulty levels for themselves when performing push-ups, playing fitness games, and planning workout routines. Although game-based and activity-planning formats were

perceived as most suitable because they afforded participants choice (i.e., autonomy), these events constituted only a small proportion of the overall workout session (29%; 7 out of 24 sessions). Despite the limited focus on participant choice throughout the program as a whole, most participants valued such opportunities and expressed their desire for more options, while participating in exercise sessions. One participant, Ines, felt the programs could include 'more options" for participant choice within each session because "a lot of people don't have motivation [for all of the exercises], just only for certain things." Similarly, Gabriela appreciated times that program staff gave her different options such that she "wasn't being forced to just do certain exercises [she] didn't like" and "could either do the one that they [the rest of the group] were doing or not." Some participants also described a desire for additional opportunities to choose their own exercises during sessions, specifically because they wanted the exercises to be more challenging than those included in the protocol. While session protocols included options for completing variations of many exercises, most were designed to make the workout easier (i.e., knee push-ups), thus, there were limited opportunities for participants who wanted to challenge themselves by make workouts harder. For example, April explained to the research team that she would have liked "a little bit more choices because some of them [exercises]…are really easy" and were not as challenging as exercises she might have chosen, "cause I want to do, like the harder ones I guess."

Throughout the intervention, participants learned not only cardiovascular and muscular endurance fitness workouts, but also new types of exercises, such as yoga, boxing, and martial arts. To assist with participant familiarity, each new activity was introduced in one session and then refined in the following sessions. While it took participants some time to get used to these new types of exercise, participants found both the new content and instructional approach (i.e., reviewing and building upon new content across sessions) helped them to feel more confident with the new content. For example, Maya recalled that while she was unsure at first, she became more comfortable throughout the program because: "Now, I'm more used to the exercises, I know more about them." She further explained that trying new exercises "kinda boosts my confidence because you know how to do the workout that I didn't really used to do…I feel like it prepared me for the future."

Most participants viewed the chance to try unfamiliar types of exercise as an appropriate positive attribute of the BRAVO! and BRAVO!+ programs. Often, participants noted interest in incorporating diverse types of exercises into their daily routines following program participation. For example, April recalled that through BRAVO!, she learned that she "liked lifting weights" and "a lot of the exercises in taekwondo because I'd love to learn more about it" following the program. Like April, many participants hoped to continue what they had experienced at BRAVO!/ BRAVO!+ outside of the program and explore additional sports and activities beyond those included in the curriculum. Maya described how her relationship with physical activity had changed in a similar manner, stating: "Hopefully, now that I'm starting to workout with different exercises, I was hoping to do, like, lacrosse or a sport for my school." Thus, the contents of the workout session were regarded as suitable for motivating participants to engage in physical activity during their leisure time.

All participants evaluated that the nutrition education was helpful in providing useful information to choose healthy food and live a healthier lifestyle. The participants mentioned that the program had changed them to become healthier people because they had an opportunity to learn and acknowledge what they should be eating or not, and they could become more conscious about their food choices through the nutrition sessions. Although this session was conducted for approximately 30 minutes once every week, it is supposed that nutrition education may have led to a significant change in the participant's overall health behavior. For example, Sophia explained that the program had improved her self-image regarding health "because, like, now I understand what I should be eating and not eating what I should be doing and not doing."

3.4.2. *Satisfaction*

All participants regarded their involvement in the intervention programs positively. In general, participants described positive interactions with program instructional staff. Many participants reported feeling connected with the instructors, describing them as supportive and approachable. Sophia recalled that "all the instructors were really nice, and I could like joke around with them, and they're all funny." However, several participants stated the need for more encouraging words from the instructors and detailed information about their workouts when they do not feel competent enough. While Sophia found the instructors to be approachable, she noted the need for additional feedback throughout sessions and suggested that instructors could "maybe explain the exercises a little more in case anybody's confused" prior to beginning each workout so that they "don't really single anybody out if they're not doing it right" after each workout had begun. Likewise, April expressed that she would have preferred that the instructors "encourage me a little bit more help me do different exercises" when she was unsure whether she was performing an exercise correctly.

Despite reporting a positive rapport with staff, participants described the workout sessions as mostly quiet and lacking opportunities to be social with one another. When asked about a time in which she connected with other program participants, Gabriela recalled that there were "none really, I didn't really talk to anybody." Ines noted that this lack of peer interaction had impacted her enjoyment of the program overall, because "it would have been more fun if people in our classroom were talkative, more enjoyable." This lack of interaction may have stemmed from the absence of ice-breaking activities and group or pair activities throughout the intervention. The majority of participants expressed a preference for a friendly and comfortable environment that would encourage more interaction. To create an enjoyable atmosphere, it is important to intentionally provide opportunities for participants to communicate with each other by integrating cooperative activities.

Finally, BRAVO!+ participants (i.e., participants with dogs) specifically highlighted that participating in the intervention with their dogs made their experience more positive because they found exercising with their dogs created a fun and comfortable environment. They also described satisfaction with the program because it helped them and their dogs toward healthier lifestyles as exercise companions. Maya was satisfied with the program because it helped her to keep her dog active by going for walks 2-4 times a week. She explained that:

"I liked it because I think not only was it good for me, but it was also good for my dog, you know, not a lot of dogs get like the physical activity that they need. But I mean, it's fun to know you're

with your dog. You're not doing it alone. You are in it together and it's just…fun. It's like a win-win for both of y'all."

4. Discussion

The purpose of this study was to examine the program adaptation, limited efficacy, and acceptability of BRAVO! and BRAVO!+ lifestyle intervention programs to improve BMI, self-determined motivation, and well-being in overweight and obese Hispanic adolescents. The results of the study indicated a moderate acceptability for the BRAVO! and BRAVO!+ programs. In addition, the results suggested good satisfaction and suitability for BRAVO! and BRAVO!+ programs, with important suggestions for the future.

Attendance and retention for both intervention modalities were poor. BRAVO!+ participants' attendance rate was 64.58% with 15.5±5.68 sessions on average (out of 24), which was higher than the average 13.5±8.67 (56.25%) sessions attendance for the BRAVO! group. The effectiveness of any intervention is dependent on participation; thus, the low attendance is not optimal. Attendance for both intervention programs was low compared to the reported attendance of the previous BRAVO! cohorts (Deng et al., 2024). Previous studies have suggested that human-pet-dog attachment can improve human participants' physical activity engagement (Gadomski et al., 2017; Wohlfarth et al., 2013). In this study, participants suggested that their pet's participation in the intervention was fun and brought comfort to them. Therefore, it may be that positive perceptions of accompanying dogs could have positively influenced BRAVO!+ participants' attendance rates. Further studies are needed to determine whether pet dogs can improve the program efficacy of pediatric lifestyle interventions. Secondly, the BRAVO!+ group had a higher drop-out rate than the BRAVO! group (63.63% vs. 33.33%), suggesting rather poor retention. While one participant from the BRAVO!+ group provided a clear reason for the withdrawal (moving to a new location), unfortunately, six other participants dropped out without providing a particular reason. This dropout was considerably higher than showed in the previous cohorts of BRAVO!, including the Deng et al. (2024) reported 20% dropout rate. Typical personal reasons for intervention dropout are a lack of motivation and interest (Alfonsson et al., 2016; Lofrano-Prado et al., 2022). In addition, because the interventions were held on weekdays (Tuesday and Thursday nights) during the participants' school year, participants' different obligations (e.g., school homework or part-time jobs) could contribute to the low retention. Considering that dropout was greater in the pet-dog group, dog participation may add another layer of stress to families and may, thus, contribute to poor retention. For the future direction, recording the reasons for missing the intervention days can provide valuable information.

Our analyses showed that none of the intervention group participants met benchmark intensity levels. Participants' subjectively measured perceived exertion ($M_{bravo!}$ = 4.20±0.68; $M_{bravo!+}$ = 2.84±0.44) did not meet the target benchmark of 5 or 6, which translates to moderate-to-vigorous intensity physical activity. These findings were corroborated by the findings of the objectively measured heart rate values. An average Fitbit Aspire 2 measured exercise exertion during the main activity ranged from 118.24 beats / min for the BRAVO! group to 123.57 beat / min for the BRAVO!+. These findings suggest that both intervention modalities in this study produced lower perceived exercise intensity compared to the previous BRAVO! study (self-reported exercise exertion M = 5.66±1.40) (Deng et al., 2024). Finally, our interview data corroborated these findings, suggesting that participants should have had more opportunities to improve their exercise intensity. This narrative suggests that exercise exertion may have been too low for them, at least during some training sessions. Notably, some exercises, such as yoga and Taekwondo, were pretty low in exercise intensity. In addition, it may be that participants' ability to select the most suitable exercises allowed them to select intensity levels that led to them not meeting the benchmark intensity levels.

On the limited efficacy, our study could only provide some descriptive findings. Due to a small sample size, any of our variables did not meet the statistical significance, but our mean-level exploration suggested a positive trend. BRAVO!+ groups BMI changed from 33.08 to 32.23 kg / m^2, while Deng et al. (2024) BRAVO! study found BMI values to improve from 35.09 to 33.51 kg / m^2. In addition, the findings of this study suggest that participants had the relatively high intrinsic motivation and integrated and identified regulations while lower introjected / external regulations and amotivation. These are positive findings, as integrated and identified regulations have been shown to be important determinants of long-term exercise adherence (Teixeira et al., 2012). It is worth mentioning, that mean-level changes in motivational regulations supported the central postulation of the SDT, with adaptive motivation increasing and maladaptive motivation declining across the intervention. Following a similar pattern with adaptive motivational regulations, psychological well-being scores changed from 3.25 to 3.30. These findings are encouraging, as it has been shown that childhood obesity is positively related to mental and social ill-being (e.g., higher depression, social rejection, and bullying; Griffiths et al., 2010).

Lastly, the results derived using qualitative methodology suggested relatively good acceptability of both intervention programs. In regard to suitability, our result indicated that participants perceive both intervention programs suitable. BRAVO!+ participants communicated that the dog-participation made their overall experience positive and satisfactory. Participants reported that the program was more fun and comfortable (welcoming) as they could spend time with their pet dogs while in the program. In addition, they appreciated that they had a possibility to make choices for themselves during the program. For instance, they expressed that they were given choices when performing push-ups or planning workout routines. Despite these suggestions of increase autonomy and ownership, participants expressed that they should have more options and more challenging fitness activities. Together with the low exercise exertion scores recorded, the hopes for more challenging activities suggest that exercise intensity could have been greater. That would also impact exercise response and, hence, efficacy of the intervention regarding to body composition and physiological outcomes. Participant feedback was somehow conflicting, as participant had possibilities to select more physically demanding activities (pushups vs. knee pushups), but we did not collect any data whether participants utilized those opportunities. It may be that in the future, participants need more guidance in selecting more high intensity activities. In addition, our study suggests that participant had high satisfaction in both programs. BRAVO!+ participants, specifically, expressed that participating in the intervention with their dogs made their experience in the program more positive. Specifically, they experienced the program more fun and comfortable when bringing their dogs and spending time

together in the program. Participant satisfaction also increased because of good relationships with instructors. Many participants reported feeling connected with the instructors, describing them as supportive and approachable. Their comments suggested, however, that there were not enough interactions among the participants themselves. This is an important finding, since the social interaction offered by weight management programs impacts participants' initial motivation to attend as well as their sustained involvement throughout these programs. In particular, interactions with peers of similar age, weight status, and activity level have been shown to exert a positive influence on attendance rates among participants (Kelleher et al., 2017). In addition, our interviews suggested that participants were sometimes not familiar with the exercises. Several participants stated the need for more encouraging words from the instructors and detailed information about their workouts when they do not feel competent enough. This could be approached in different ways. One approach is to make sure that all activities are explained and demonstrated well. In addition, all instructors need to be helping the participants. During these BRAVO! cohorts, typically, there are several instructors directing and performing the exercise alongside the participants. However, there may be some individual variation between instructions. Future efforts should be directed towards making sure that all staff in the study are appropriately trained to deliver the intervention. Instructor training for this cohort included two times two-hours of training, with a focus on need- supportive instruction and data collection.

The following limitations should be considered when interpreting the findings of the study. First, this study was a pilot study measuring the effectiveness of BRAVO!+ intervention program for adolescents and their pet dogs. The sample was very small, thus, future fully powered studies are needed to test traditional intervention efficacy, intervention effectiveness, and dissemination / implementation stages (Onken, 2022). Our sensitivity analysis suggested that the between group effect size should have been bigger than 2.12 to reach the .80 power and .05 statistical significance. The highest effect size in our study variables was 1.11, thus lacking power to detect statistically significant changes. Secondly, the participants in the BRAVO!+ group did not participate in a post-test. Because of this limitation, direct comparison between the BRAVO! and BRAVO!+ could not be reported. Finally, this study did not collect any recruitment capability data. Future study efforts should be conducted to examine the extent to which pet-dog participation impacts successful participant recruitment for pediatric lifestyle interventions, and to harness athletes' task- and autonomy-support (Campbell et al., 2022).

5. Conclusion

Although both intervention groups had poor participant retention, participants who actually completed the program had moderate attendance rates. In addition, participants indicated good program suitability and satisfaction. For instance, BRAVO!+ group participants stated that participating in the program with their pets was more fun and comfortable. However, it is noteworthy that the pet-dog intervention group experienced a high dropout rate. It may be that the requirement to bring in dogs to intervention sessions may contribute to poor retention. However, on average, program attendance was higher in the pet-dog group than in the human participant group. Understanding participants' reasons for dropping out and increasing the overall exercise intensity of the future BRAVO! and BRAVO!+ programs would further strengthen the programs and assist the participants to receive more significant benefits.

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References

Alfonsson, S., Olsson, E., & Hursti, T. (2016). Motivation and treatment credibility predicts dropout, treatment adherence, and clinical outcomes in an internet-based cognitive behavioral relaxation program: a randomized controlled trial. *Journal of Medical Internet Research*, *18*(3), e5352.

Bandura, A. (2012). Social cognitive theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 349–373). Sage Publications Ltd.

Berge, J. M., & Everts, J. C. (2011). Family-based interventions targeting childhood obesity: A meta-analysis. *Childhood Obesity*, *7*(2), 110–121.

Borg, G. (1998). *Borg's perceived exertion and pain scales*. Human Kinetics.

Brown, H., Atkin, A., Panter, J., Wong, G., Chinapaw, M. J., & Van Sluijs, E. (2016). Family‐based interventions to increase physical activity in children: A systematic review, meta‐analysis and realist synthesis. *Obesity Reviews*, *17*(4), 345–360.

Campbell, S., Manninen, M., & Yli-Piipari, S. (2022). Connecting theory to practice: How psychological need-supportive coaching improves athlete motivation. *Journal of Physical Education, Recreation & Dance, 93*(1), 28–35.

Cawley, J., & Meyerhoefer, C. (2012). The medical care costs of obesity: An instrumental variables approach. *Journal of Health Economics*, *31*(1), 219–230.

Children's Hospital of Philadelphia Research Institute. (n.d.). *BMI Z-Score Calculator*. https://zscore.research.chop.edu/calcbmi.php

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist*, *26*(2), 120–123.

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*(2), 109–134.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268.

Deng, Y., Hwang, Y., Kim, T., Hernandez, L., & Patel, M., & Yli-Piipari, S. (2024). Psychological need-support centered lifestyle program to prevent pediatric obesity among Hispanic adolescents: A randomized controlled trial. [Manuscript submitted for publication].

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, *49*(1), 71–75.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates: Amid calls for health reform, real cost savings are more likely to be achieved through reducing obesity and related risk factors. *Health Affairs*, *28*(Suppl1), 822–831.

Fryar, C. D., Carroll, M. D., & Ogden, C. L. (2018). Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2-19 years: United States, 1963-1963 through 2015-2016. *National Centre for Health Statistics: Health E-Stats,* 1–6.

Gadermann, A. M., Schonert-Reichl, K. A., & Zumbo, B. D. (2010). Investigating validity evidence of the satisfaction with life scale adapted for children. *Social Indicators Research*, *96*, 229–247.

Gadomski, A. M., Scribani, M. B., Krupa, N., & Jenkins, P. (2017). Pet dogs and child physical activity: The role of child–dog attachment. *Pediatric Obesity*, *12*(5), e37–e40.

Griffiths, L. J., Parsons, T. J., & Hill, A. J. (2010). Self-esteem and quality of life in obese children and adolescents: A systematic review. *International Journal of Pediatric Obesity*, *5*(4), 282–304.

Ho, M., Garnett, S. P., Baur, L., Burrows, T., Stewart, L., Neve, M., & Collins, C. (2012). Effectiveness of lifestyle interventions in child obesity: Systematic review with meta-analysis. *Pediatrics*, *130*(6), e1647–e1671.

Kelleher, E., Davoren, M. P., Harrington, J. M., Shiely, F., Perry, I. J., & McHugh, S. M. (2017). Barriers and facilitators to initial and continued attendance at community-based lifestyle programmes among families of overweight and obese children: a systematic review. *Obesity Reviews*, *18*(2), 183–194.

Lofrano-Prado, M. C., Donato Junior, J., Lambertucci, A. C., Lambertucci, R. H., Malik, N., Ritti-Dias, R. M., Correia, M. A., Botero, J. P., & Prado, W. L. (2022). Recreational physical activity improves adherence and dropout in a non-intensive behavioral intervention for adolescents with obesity. *Research Quarterly for Exercise and Sport*, *93*(4), 659–669. https://doi.org/10.1207/S15327965PLI1104_01

Manninen, M., & Yli-Piipari, S. (2021). Ten practical strategies to motivate students in physical education: Psychological need-support approach. *Strategies*, *34*(2), 24–30.

Markland, D., & Tobin, V. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, *26*(2), 191–196.

McLoone, P., & Morrison, D. S. (2014). Risk of child obesity from parental obesity: Analysis of repeat national cross-sectional surveys. *The European Journal of Public Health*, *24*(2), 186–190.

Ogden, C. L., Fryar, C. D., Martin, C. B., Freedman, D. S., Carroll, M. D., Gu, Q., & Hales, C. M. (2020). Trends in obesity prevalence by race and Hispanic origin-1999-2000 to 2017-2018. *JAMA*, *324*(12), 1208–1210. https://doi.org/10.1001/jama.2020.14590

Onken, L. (2022). Implementation science at the National Institute on Aging: The principles of it. *Public Policy & Aging Report*, *32*(1), 39–41.

Peirson, L., Fitzpatrick-Lewis, D., Morrison, K., Ciliska, D., Kenny, M., Ali, M. U., & Raina, P. (2015). Prevention of overweight and obesity in children and youth: A systematic review and meta-analysis. *Canadian Medical Association Open Access Journal*, *3*(1), E23–E33.

Reinehr, T. (2013). Lifestyle intervention in childhood obesity: Changes and challenges. *Nature Reviews Endocrinology*, *9*(10), 607–614.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. The Guilford Press.

Simmonds, M., Llewellyn, A., Owen, C. G., & Woolacott, N. (2016). Predicting adult obesity from childhood obesity: A systematic review and meta‐analysis. *Obesity Reviews*, *17*(2), 95–107.

Singh, A. S., Mulder, C., Twisk, J. W., Van Mechelen, W., & Chinapaw, M. J. (2008). Tracking of childhood overweight into adulthood: A systematic review of the literature. *Obesity Reviews*, *9*(5), 474–488.

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1–30.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837–851.

Wang, Y., Beydoun, M. A., Min, J., Xue, H., Kaminsky, L. A., & Cheskin, L. J. (2020). Has the prevalence of overweight, obesity and central obesity levelled off in the United States? Trends, patterns, disparities, and future projections for the obesity epidemic. *International Journal of Epidemiology*, *49*(3), 810–823.

Wilson, P. M., Rodgers, W. M., Loitz, C. C., & Scime, G. (2006). "It's Who I Am… Really!" The importance of integrated regulation in exercise contexts. *Journal of Applied Biobehavioral Research*, *11*(2), 79–104.

Wohlfarth, R., Mutschler, B., Beetz, A., Kreuser, F., & Korsten-Reck, U. (2013). Dogs motivate obese children for physical activity: Key elements of a motivational theory of animal-assisted interventions. *Frontiers in Psychology*, *4*, 796.

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