STUDENT NAME: *S. Villeneuve*

PROJECT TITLE: The Aboriginal Youth Mentorship Program (AYMP): A peer-led healthy living after school program for achieving healthy weights and creating mentorship skills among First Nations children living in a northern isolated setting.

STUDENT'S NAME: Stephanie Villeneuve
SUPERVISOR'S NAME: Dr. Jonathan McGavock

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SUMMARY:
OBJECTIVE: To assess the efficacy of a peer-led healthy living program on weight gain, and body composition, as well as knowledge of healthy foods and activities when run in a remote isolated community. DESIGN: A non-randomized experimental trial with a parallel non-equivalent control group performed with two student cohorts between January and May in the 2011 and 2012 school years. SETTING: Kistiganwacheeng Elementary School, Garden Hill First Nation. PARTICIPANTS: A total of 151 students in grades 4 and 5 (41.72% girls). INTERVENTION: The intervention was offered to grade 4 students as a weekly after school program facilitated independently by the high school mentors. Weekly lesson plans focused on four different areas of wellbeing that contribute to healthy weight: knowledge of healthy living, physical activity, healthy eating, and social support. OUTCOME MEASURES: The primary outcome measures studied were the change in waist circumference and body mass index z-score (BMI z-score). Secondary outcome measures include healthy living knowledge, self efficacy, and body image. RESULTS: Within the entire cohort, 72.67% of the children were overweight or obese. Using a linear mixed effects model with repeated measures (adjusted for weight and time), the increase in waist circumference was significantly less in the intervention group, relative to the control group (+3.4 ± 1.37 cm vs 0.39 ± 0.66 cm; p=0.0001). The BMI z-score increased significantly in the control group (0.07 ± 0.2 vs -0.05 ± 0.03, p=0.199), but was unchanged within the intervention group. There was no significant difference between the groups in post measurement.

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Student's Signature

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Supervisor's Signature

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is one of the fastest growing chronic illnesses worldwide and disproportionately affects Indigenous People from all continents[1-6]. Within Aboriginal communities in Canada, the age-standardized point prevalence of T2DM is between 24 and 28%[6-8], a rate 3-5 times higher than the national average. Unfortunately, these trends are not restricted to adults, as T2DM and its complications are increasing at alarming rates in Aboriginal youth[4,9-15]. Within Manitoba, the clinical incidence of T2DM in young people has continued to increase by a factor of 10 over the past decade[11]. The public health implications of this trend are staggering considering the large burden of complications in young Aboriginal people with T2DM and the aggressive rate at which complications develop[6, 16-19].

The disproportionate risk for T2DM in Aboriginal youth may be explained by the predisposition for obesity and central adiposity in this population[20]. The reasons for the increased rates of obesity in Aboriginal populations are not certain. Simplistically, it can be explained by a positive caloric imbalance. However, the factors that lead to increased caloric intake or reduced energy expenditure among Aboriginal youth can be attributed to differences in early life events, the family feeding environment, food insecurity, school environments, historical circumstances, and genetic factors [21-23]. Due to the unique socio-cultural factors facing Aboriginal youth today, culturally tailored approaches are needed to reduce the risk of obesity and consequently T2DM.

It is widely recognized that a population-wide strategy is needed to combat the onset of weight gain typically associated with puberty and adolescence. Several landmark studies, in particular the Sandy Lake Diabetes Prevention Project and the Kahnawake Schools Diabetes Prevention Project have been designed to reduce T2DM in youth through socio-ecologic interventions. These studies demonstrated impressive changes in healthy living behaviours (i.e. increased activity and healthy food choices) but did not improve body composition [24-25]. The lack of effectiveness may be misleading, as neither intervention included a parallel control group with repeated measures of adiposity. Accordingly, the current best practice for attenuating weight gain in Aboriginal youth within a school setting remains unclear.

In contrast to conventional school-based interventions, novel peer-led approaches have emerged as an attractive approach to eliciting behaviour change. Peer mentoring removes the authority figure from the learning process, replacing them with peers that learners can relate to. Credibility increases when the elementary students are learning from older social peers, who understand and can relate to their circumstances, appreciate their barriers, and help to form realistic goals [26-27].

In light of the positive effects of peer mentoring on weight gain, we designed a community-based participatory action study to test the hypothesis that weight gain will be attenuated in Aboriginal youth participating in an after school peer-led mentoring program compared to those who are not participating in the program. We further hypothesized that the reduced weight gain would be associated with improvements in healthy eating patterns, physical activity levels, and self-efficacy.

MATERIALS AND METHODS

Study Design

We designed a non-randomized experimental trial with a parallel non-equivalent control group to test the study hypothesis. The intervention was offered to students in grade 4. The control group consisted of students in grade 4, who did not want to participate in the intervention, and a cohort of grade 5 students. The intervention was delivered from January to May (5 months) in the winter semesters of the 2010-2011 and 2011-2012 academic calendar years. A quasi-experimental approach was used in place of a randomized control trial as the community advisors were uncomfortable with the randomization process. Specifically, they did not like the idea of withholding the programs from families willing to support the participation of students in the after-school program. This approach has been used successfully in other school based interventions, in similar circumstances, where randomization was not possible [26]. Consent forms were given to all grade 4 and 5 students at the beginning of the school year, requesting parental consent to measure height, weight, waist circumference, self-efficacy as well as diet and physical activity patterns. A permission form was required for grade 4 students participating in the intervention. As most of the children are transported by the school bus, the permission form was to acknowledge that alternative arrangements could be made on the days the intervention was taking place. The protocol was approved by the Biomedical Research Ethics Board at the University of Manitoba in accordance with the Declaration of Helsinki.

Study Population

Students in grade 4 and 5 from the Kistiganwacheeng Elementary School in Garden Hill First Nation were invited to participate in the study. Garden Hill First Nation is a remote Oji-Cree First Nation in northeast Manitoba with a population of ~3000 people. Kistiganwacheeng Elementary School offers classes from Kindergarten to Grade 6. There are 4 classes of 25-30 children in both grades 4 and 5. The intervention was offered to the grade 4 group for four primary reasons: (1) the majority of grade 4 students are in tanner stage 1, limiting the confounding weight gain associated with puberty; (2) previous experience in the community revealed that attendance is consistently higher among grade 4 students relative to grade 5 or 6; (3) grade 4 students are old enough to perform the low organized games included in the intervention; and (4) retention rates in the intervention group are greater than students in grade 5 and 6. No students were excluded from participation in the intervention or the control group.

Intervention

The Aboriginal Youth Mentorship Program (AYMP) was developed by teachers and Aboriginal youth in Winnipeg's inner city to provide a supportive, holistic approach to physical activity, nutrition, and education programming [28-29]. The AYMP uses a peer mentoring model that has been proven to enhance knowledge of healthy living and prevent weight gain in urban settings [30]. Garden Hill First Nation agreed to pilot the program in the 2010/2011 and 2011/2012 school years, allowing for the evaluation of the effectiveness of this model in a remote setting. It is designed to provide healthy after-school programming for early years children while simultaneously building leadership skills and knowledge of healthy living in adolescents attending the local high school within a culturally relevant framework. The high school students form a network of mentors, which are integral in introducing a novel social network of healthy living to the school and community environment. The program was designed using the medicine wheel concept to guide the program components. Specifically, the curriculum focuses on four

different areas of well being that contribute to healthy weight: knowledge of healthy living, physical activity, healthy eating, and social support (Figure 1).

Mentors were recruited from the Garden Hill First Nation High School between grades 7 and 12. In the urban programs, older adolescents (grades 9-12) are recruited as mentors for the AYMP on the basis that they are more mature and, therefore, they are perhaps more comfortable with role of a mentor [31]. In the Garden Hill pilot project, a number of younger students were interested in the program and worked very well alongside other students. Therefore, the mentor age range was expanded to include individuals in grades 7-9.

The program incorporated two different levels of mentoring. First, adults (e.g. recognized community leaders, supporting teachers, or a "young adult leader") worked with the high school mentors to design and deliver an after school program for early years students that is tailored to the needs of community. As a team, the high school mentors met weekly to prepare an engaging session for the elementary school students in health based educational activities. They planned for the weekly sessions by including: (1) peer-teaching of games and activities in the gym, (2) sharing of knowledge about healthy foods to prepare for the children, and (3) preparation of educational games and activities. While the adult leaders assisted with the planning process and provide guidance when needed, the high school mentors facilitated the program to their mentees without assistance.

Outcome Measures

The primary outcome measure for this study was waist circumference. This is a clinically relevant outcome as it is a robust predictor of T2DM and other cardiometabolic outcomes in children [32]. The waist circumference was measured in duplicate at the height of the iliac crest to the nearest 0.5 cm. The secondary outcome measure was body mass index z-score (BMI z-score) which was calculated from height and weight measurements and converted to a z-score based on normative data from age and sex matched children in the United States using specialized software (EpiInfo). Body weight was measured to the nearest 0.1kg in duplicate using a digital scale that was calibrated each morning. Height was measured to the nearest 0.1cm in duplicate using a medical standard stadiometer (Seca Portable Model 214), which was calibrated using a standard measuring tape each morning. All measurements were taken in light indoor clothing (e.g. shorts, t-shirt). Research assistants collecting data were blind to the participants treatment arm among grade 4 students, but were not blinded to the students grade.

The exploratory outcomes assessed included self efficacy as well as physical activity and healthy eating knowledge. These were collected using a self-report Healthy Living Questionnaire, which has been used in previous school-based peer mentoring interventions [26]. Body image was determined to assess the development of a negative body image due to teaching weight related health behaviours. To report body image, students were given a scale of 7 schematic figures representing different body sizes. Each child was given three scales (two matching their gender, and one opposite) and were asked to rate which figure they believed most closely matched their current self, their ideal self, and the ideal body size of the opposite sex[26].

Timing of Follow-up

The intervention is delivered over a 5 month period coinciding with the winter semester of each academic year. This also falls within a natural lull in physical activity that is common in colder climates, giving these children a place to exercise when weather and a lack of open facilities may otherwise impede them[33]. The duration was selected to achieve a balance between achieving an adequate mentoring dose and to minimize the likelihood of attrition.

Data Analysis

Data are presented as means and 95% confidence intervals unless otherwise stated. Data from each year the intervention was offered was pooled. BMI z-score was calculated from normative data provided in growth charts from the Centers for Disease Control using a software program (EpiInfo). Overweight and obese were defined by the calculated BMI percentiles: percentiles that fall within the range of 85-94.9 were categorized as overweight, while values equal to or above the 95th percentile were categorized as obese. Differences between groups at baseline were assessed using a standard analysis of variance (ANOVA). To test for group, time, and time-group interaction effects on waist circumference, we used a linear mixed effects model with repeated measures, controlling for baseline weight to test for differences in the change in waist circumference, body mass, and self-reported knowledge and lifestyle behaviours between the groups. A $p < 0.05$ was considered statistically significant. We did not employ an intention to treat analysis as participants were not randomized to control or intervention groups.

RESULTS

Participant Characteristics: There were 151 students were recruited to participate in baseline testing. Over the two-years of the program, 50 grade 4 students participated in AYMP and 100 students served as controls. All students completed both pre and post anthropometric measurements, and 80 students completed both the pre and post Healthy Living Questionnaire. Of the participating students, 42% were girls and 73% were considered overweight or obese (Table 1). At baseline, despite differences in age between the intervention and control groups, we found no differences in waist circumference, BMI z-score or the prevalence of overweight or obesity (Table 1).

Primary Comparisons: Data for the primary outcome variables are presented in Table 2. The 5-month change in waist circumference was significantly lower in youth who received the intervention compared to students that were in the control group ($+3.4 \pm 1.4$ cm vs 0.39 ± 0.66 cm; $p=0.0001$; Figure 2). BMI z-score significantly increased in the control group and decreased slightly in the intervention group (0.07 ± 0.2 vs -0.05 ± 0.03, $p=0.199$; Figure 3). BMI z-score at the end of the follow-up period was significantly lower in the intervention group compared to the controls (1.24 ± 0.04 vs 1.32 ± 0.04, $p=0.0021$; Figure 4).

Secondary/Exploratory Outcome Measures: Data for the secondary outcome measures are presented in Table 3. Healthy Food Choices knowledge ($p = 0.02$) and knowledge of physical activity scores ($p=0.0004$) were significantly higher in the control group relative to the intervention group at baseline. The change in knowledge of physical activity and dietary behaviours was not significantly different between the groups following the intervention period.

Self-efficacy was significantly higher in the intervention group relative to the control group in both the pre ($p=0.0409$) and post ($p=0.0045$) measures; however, there were no significant changes between the pre and post measures within each group. The average perception of body image was significantly different at baseline ($p=0.0084$), with the intervention group showing a greater discrepancy between their current and desired weight than the control group. These differences were no longer evident at the 5 month follow-up period, as children in the intervention group experienced a significant improvement in their body image ($p = 0.03$), showing a decrease in the difference between their perceived and desired weight status. The change in body image with the intervention however, was not statistically significant between the groups.

DISCUSSION

To the best of our knowledge, this is the first experimental school-based trial of peer mentoring on measures of obesity, self efficacy and knowledge of healthy living behaviours in children from a northern isolated First Nations community. The results from this study revealed several novel findings, and support results from previous experimental trials of peer mentoring. Specifically, we found that, similar to other trials [26,34], a school-based peer mentoring program led to an attenuation of weight gain and central adiposity in grade 4 students. Additionally, we found that students exposed to a peer mentoring program experienced a modest improvement in body image relative to students not exposed to the program. Collectively, these data provide preliminary evidence that peer-based approaches are efficacious for achieving modest weight maintenance in a First Nations community disproportionately affected by childhood obesity.

The students who were exposed to the program had significantly higher self efficacy than those in the control group at baseline and at program completion. Self efficacy is associated with an individuals' confidence and their belief that they can overcome challenges set before them. Self-perceptions and self-efficacy are important predictors of physical activity in adolescents and children [35]. As the intervention was self-selected among the grade 4 students, this difference may be the result of a selection bias, implying that individuals with a lower self-confidence may not be interested in participating in this type of after school program.

Similar to previous studies by our research team[5] and others [21,36-37], rates of obesity in school aged children living in rural isolated First Nations communities are nearly three-fold higher than the national average (70 vs. 26%)[38]. Timing is key for these individuals as there is a decline in physical activity and increase in obesity rates in children after the age of 12 years[39]. In addition, television viewing and increased physical inactivity has been reported as early as age 6 in some cohorts, which strengthens the argument that interventions need to begin earlier in life[40]. Obesity in the adolescent period is predictive of obesity in adult life, therefore, it is important to intervene before weight gain ensues [37]. Also, as mentioned previously, Aboriginal people have a greater tendency to develop central adiposity, which is a risk factor for the development of many metabolic disorders, including T2DM [20,25]. The data reinforces the urgent need for culturally tailored programs aimed at reducing the risk factors for overweight among First Nations youth. Initiatives aimed at various critical time periods for altering weight status should be considered. Maternal-specific programs could include proper and complete prenatal care, and health education on the topics of proper nutrition, exercise, and gestational diabetes prevention. Early

school years interventions like our current study may encourage a healthy lifestyle to combat obesity through increased physical activity and healthy eating based on local available resources. Other school-based diabetes prevention programs have adopted policies to ban high sugar, high fat foods at school [40-43]. The current study provides a novel culturally tailored peer-mentoring approach that is offered in an after-school setting which has initially demonstrated promise for eliciting modest changes in adiposity. The combined modest effects of the current intervention and those listed above are likely required to begin to reverse the disproportionate rates of T2DM and obesity in children living in remote First Nations communities.

There is a very limited number of experimental trials aimed at improving healthy living behaviours and reducing the risk of obesity in First Nations youth. The two trials that we found were the Kahnawhake Schools Diabetes Prevention Project, and the Sandy Lake Diabetes Prevention Project. The Kahnawhake Schools Diabetes Prevention Project was a community-wide intervention project that took place between 1994 and 2002, which was aimed at promoting healthy eating and active lifestyles among residents [40-41,43]. This was a school-based prevention program focusing on health education for students in grades 1-6. In addition to education, a policy was implemented disallowing unhealthy foods in the school. Early longitudinal data showed increased physical activity, physical fitness, and decreased television and videogaming time in children in the school[39]. Early in the intervention, children in the elementary school displayed an attenuation of triceps skin folds without any change in BMI. Unfortunately, these were not maintained for the duration of the study[43]. The Sandy Lake Diabetes Prevention Project is a school-based intervention delivered in a remote Oji-Cree community, very similar to the community that we partnered with for the AYMP intervention. The program in Sandy Lake focused on four components: curriculum, family, peer, and environment. The curriculum component includes the school-based intervention, which provided education on healthy eating, physical activity, and diabetes within a culturally relevant context. This education was extended to the family members of the youth, making up the family component of the program. They also provided opportunities for the youth involved to act as mentors/role models within their community. The environmental component of the program included banning high-fat and high-sugar snack foods in schools as well as providing a healthy lunch program. Evaluation of the program indicated a significant improvement in knowledge of healthy eating and lifestyles[41] however BMI increased among the students. In the absence of a control group the true effect of the intervention on adiposity is unknown [42]. The data presented here extend on these landmark interventions. With the addition of a control group and peer mentoring, we were able to document a significant attenuation of weight gain, in particular central weight gain in youth participating in an afterschool peer led healthy living program.

The improvement in weight status observed in this trial was similar to that seen in other peer-led healthy living interventions in non- First Nations schools. For example, the Healthy Buddies© study observed an attenuation of ~0.5 kg/m^2 in BMI in elementary school children who received the intervention, compared to controls. Healthy Buddies© is a school-based peer mentoring program in which older students (grades 4-7) were paired with younger students (kindergarten - grade 3) as their "Healthy Buddy". They provided lessons to their buddies in the areas of nutrition, physical activity, and healthy body image over the course of one school year. Using a clustered randomized controlled trial, our research group recently demonstrated that the this curriculum also attenuated the age-related change in waist circumference while increasing

knowledge of healthy living[34]. Similar to the Healthy Buddies© curriculum, we found that exposure to AYMP was associated with a significant reduction in waist circumference and weight gain in a cohort of First Nations youth living in a remote setting. In contrast to Healthy Buddies, we observed attenuated weight gain with a lower dose of the intervention and without structured curriculum. A strength in the AYMP is likely the development of both a culturally and locally relevant lesson plan for the elementary school students. The involvement of the high school mentors enabled planning with the integration of the specific challenges, barriers, and needs of their community.

Our study had several limitations. First, the sample size is limited as it is a pilot study investigating the application of the peer-mentoring model in a school-based healthy living program. While we did see a significant attenuation in waist circumference, the changes in BMI were not significant, which may change with an increased sample size. Second, physical activity was not being measured objectively, which leaves a gap in our data regarding the impact of the program on health behaviours. Third, the tool used to assess food knowledge was not validated for First Nations youth, therefore, its relevance to those living in rural communities may be questioned. Fourth, the elementary school students filled out the questionnaires in a classroom type setting; therefore, without complete privacy, it is possible that the students did not feel comfortable completing the more personal sections of the test honestly (e.g. body image). Fifth, while AYMP showed promising results in the short term, it is not known whether the impact of the program will be sustained long term.

In conclusion, the pilot data demonstrates that Aboriginal Youth Mentorship Program is an efficacious in attenuating weight gain in First Nations youth living in a remote northern setting. The peer mentoring approach also showed modest improvements in body image. The success of this pilot provides the foundation for future school-based peer-led interventions among First Nations elementary school students a remote isolated location in Manitoba.

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FIGURES, FIGURE LEGENDS, AND TABLES

Table 1. Baseline Characteristics of the Control and Intervention Groups: Sample Means (Standard Deviation)

Variable	Intervention	Control
	n = 50	n = 101
Age (years)	9.26 (0.44)	9.92 (0.72)*
Sex (F/M)	13/37	50/51
Grade (4/5)	50/0	36/65
Waist Circumference (cm)	79.85 (12.74)	83.84 (15.68)
Healthy Food Knowledge (%)	70.36 (0.14)	75.38 (0.12)*
Physical Activity Knowledge (%)	60.29 (0.22)	73.44 (0.25)*
Self Efficacy (%)	87.64 (0.12)	82.22 (0.16)
BMI z-score	1.46 (0.86)	1.48 (0.95)
Weight Class (obese/overweight/normal weight)	25/12/13	56/16/28

* $P < 0.05$ between the groups following adjustment for weight and time.

Table 2. Effects of the AYMP on measures of adiposity in a rural First Nations elementary school.

Variable	Intervention		Control	
	Pre	Post	Pre	Post
BMI z-score	1.28 (0.05)	1.23 (0.05)	1.24 (0.04)	1.32 (0.03)
Waist Circumference (cm)	76.8 (1.1)	77.2 (1.1)	80.5 (0.8)	83.4 (0.8)* ǂ
Height (cm)	140.1 (0.8)	141.4 (0.8)	144.2 (0.6)	1.8 (0.6)

* $P < 0.01$ vs intervention post; ǂ = $p < 0.05$ group x time interaction
Data are presented as Mean (SE). Raw values were adjusted for age and weight.

Table 3. The efficacy of the AYMP for change knowledge of healthy living behaviours, self-efficacy and body image in a rural First Nations elementary school.

Variable	Intervention		Control	
	Pre	Post	Pre	Post
Healthy Food Knowledge (%)	69.34 (1.84)	71.30 (1.92)	76.08 (1.37)*	72.40 (1.50)
Physical Activity Knowledge (%)	57.60 (3.26)	62.05 (3.38)	73.80 (2.42)*	75.27 (2.63)
Self-Efficacy (%)	87.64 (2.17)	90.21 (2.31)	82.22 (1.48)	82.02 (1.64)
Body Image (Ideal self - current self)	-0.92 (0.12)	-0.60 (0.13) ǂ	-0.51 (0.09)	-0.53 (0.10)

* $p < 0.05$ vs intervention at the pre time point; ǂ = $p < 0.05$ vs pre intervention

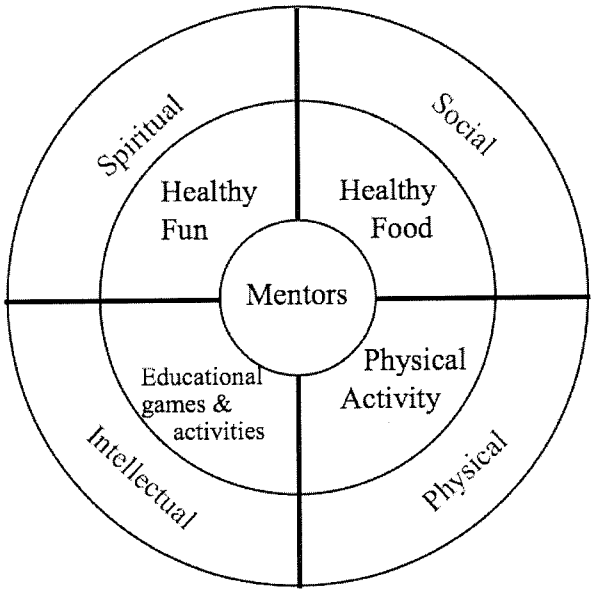

Figure 1. The AYMP Model
Using a culturally-relevant model, mentors are placed at the center of the medicine wheel where they are trained to affect four elements of wellbeing for youth. These four areas are also critical in achieving healthy weights.

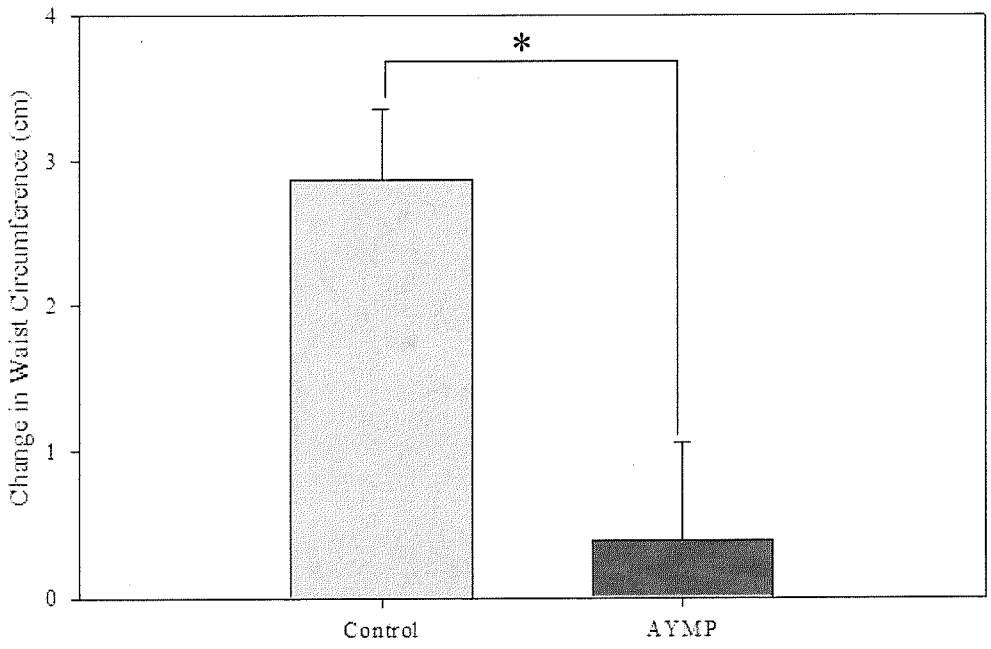

Figure 2. Mean change in waist circumference (cm) in children who received the intervention (AYMP) and controls. *$p < 0.05$

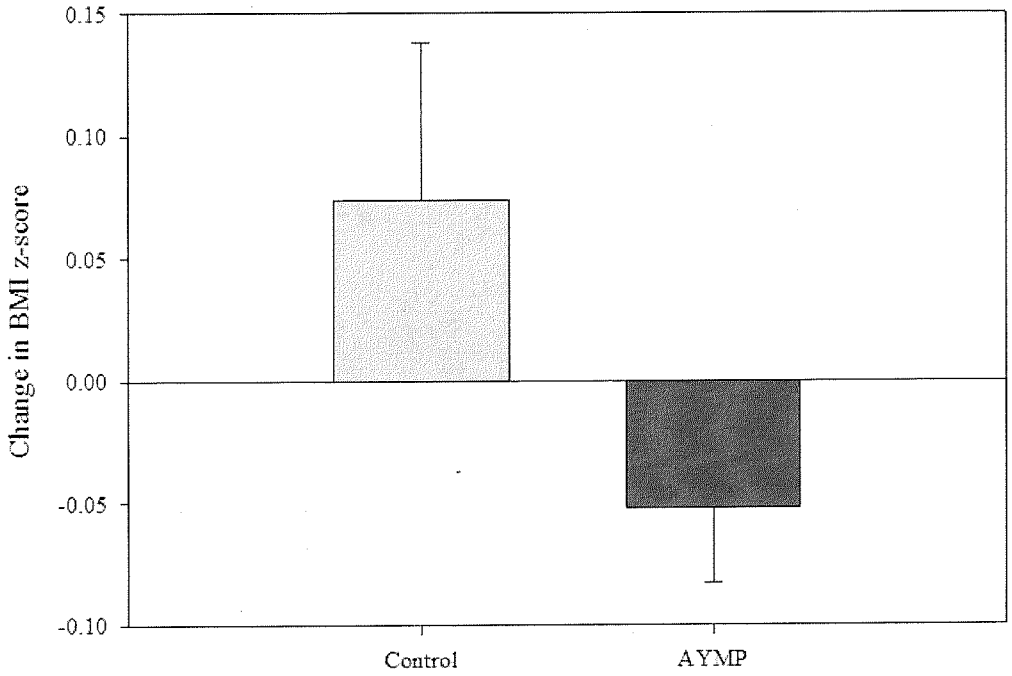

Figure 3. Mean change in BMI z-score in children who received the intervention (AYMP) and controls.

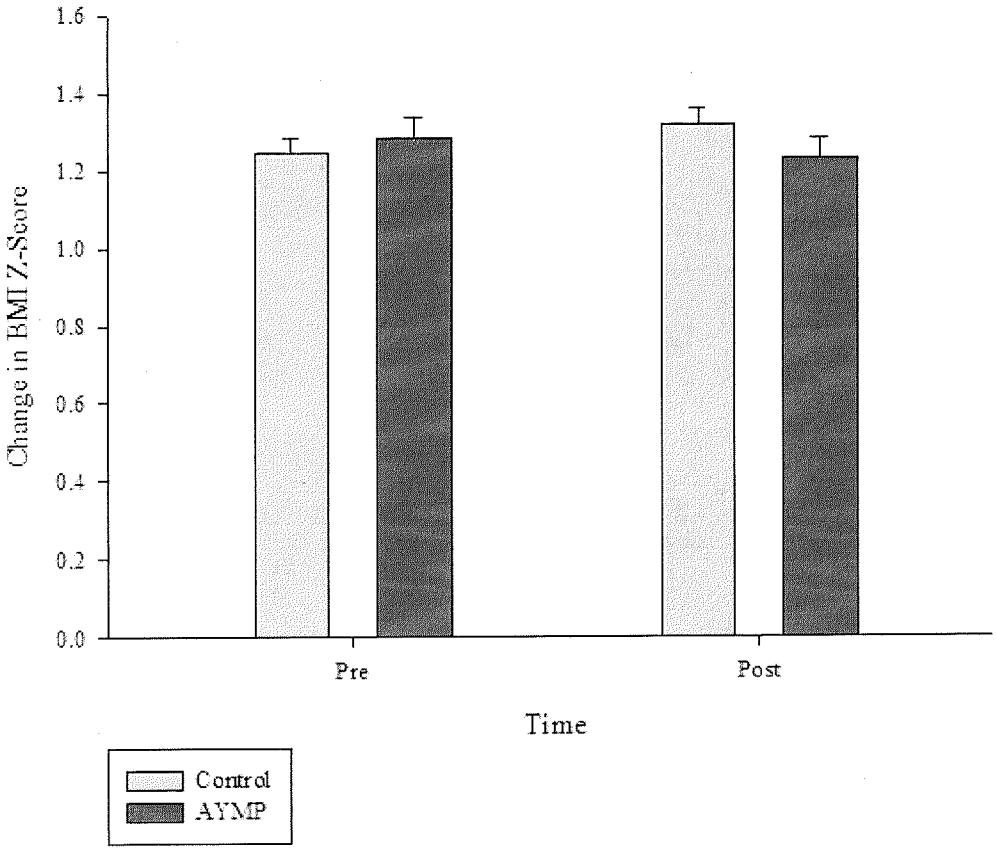

Figure 4. Mean in the pre and post measurement BMI z-scores (adjusted for time and weight class) for children who received the intervention (AYMP) and controls.