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Title: The CHANGE! Project: Changes in body composition and cardiorespiratory fitness in 10-11 year old after completing the CHANGE! Intervention

Running Head: Changes in body composition

Abstract

Purpose: To assess the effects of the Children's Health, Activity and Nutrition: Get Educated! intervention on body size, body composition and VO_2peak in a sub-sample of 10-11 year old children.

Method: Sixty children were recruited from 12 schools (N= 6 intervention) to take part in the CHANGE! sub-sample study. Baseline, post intervention and follow measures were completed in October 2010, March-April 2011, and June-July 2011 respectively. Outcome measures were BMI z-score, waist circumference, body composition assessed using DEXA (baseline and follow up only), and VO_2peak.

Results: Significant differences in mean trunk fat mass (control 4.72 kg, intervention 3.11 kg, $p = 0.041$) and trunk fat % (control 23.08%, intervention 17.75 %, $p = 0.022$) between groups were observed at follow up. Significant differences in waist circumference change scores from baseline to follow up were observed between groups (control 1.3 cm, intervention -0.2 cm, $p = 0.023$). Favourable changes in body composition were observed in the intervention group; however, none of these changes reached statistical significance. No significant differences in VO_2peak were observed.

Conclusion: The results of the present study suggest the multicomponent curriculum intervention had small to medium beneficial effects on body size and composition health outcomes.

Introduction

Childhood obesity, poor nutritional intake, low cardiorespiratory fitness (CRF) and insufficient physical activity increase the risk of developing cardiometabolic disease (2, 3, 16). Over the last decade childhood obesity has increased (UK) (8, 40). Concurrently CRF, an independent risk factor for cardiometabolic (CM) disease, has decreased independent of changes in body size and other confounders such as maturation and deprivation (7, 8, 40).

Current UK guidelines recommend children participate daily in at least 60 minutes of moderate to vigorous intensity PA (MVPA) whilst engaging in vigorous PA (VPA) at least 3 times per week (12). However, few children report meeting these guidelines (34, 36). Schools provide an ideal opportunity to implement an intervention designed to improve PA since children spend approximately half of their waking hours in school (15). Health promoting curriculum based interventions have been found to be successful in children, especially when utilising a multi-disciplinary approach, which combines PA and diet, and uses established behaviour change and social support processes (21, 43). Several intervention studies have aimed to increase PA, reduce sedentary time and improve nutritional intake in children in order to reduce CM disease risk, often reporting mixed levels of success (18, 30, 37, 38). These studies typically include measures of body size such as body mass index, skin fold thicknesses and waist circumference rather than composition. Furthermore the majority of studies assessed CRF in the field using the 20m multi-stage shuttle runs test, which although valid and reliable does not provide a direct assessment of peak oxygen uptake (VO_2peak). The Children's Health, Activity and Nutrition: Get Educated! (CHANGE!) intervention was designed to improve PA levels and healthy eating behaviours of 10-11 year old children using a school-based curriculum intervention delivered by in-service teachers (14). The main intervention outcomes have been reported elsewhere (14). Briefly, significant differences between the control and intervention group were observed in waist circumference at post intervention and BMI z-scores and light intensity physical activity at follow up. As part of the CHANGE! study a sub-sample of children were invited to take part in some additional laboratory based measures, including treadmill assessed peak oxygen uptake (VO_2peak) and DEXA scans to provide detailed information on body composition. This study reports outcomes from the sub-sample group who participated in these additional measures rather than the full CHANGE! pragmatic evaluation group. The aim of this analysis was to assess changes in measures of body size and VO_2peak between baseline and post intervention and baseline and 10 week follow between the control and intervention group in the CHANGE! sub-sample. In addition, differences in pre-follow up DEXA assessed body composition between the control and intervention groups were also examined. This study extends the previous CHANGE! pragmatic evaluation study by examining changes on reference standard measures of body composition and cardiorespiratory fitness in the sub-sample participants.

Materials and Methods

Participants and Study Design

After receiving institutional ethical approval 12 primary schools from the Wigan Borough in North West England were recruited to participate within the clustered randomized controlled pilot trial, registered with Current Controlled Trials (ISRCTN03863885). All children within Year 6 (10 - 11.9 y) were invited to take part in the CHANGE! study from each school (N = 420). At baseline informed parental consent and participant assent was received from 318 participants (75.7% participation rate), the results of the whole sample are reported elsewhere (14). A stratified random sub-sample of sixty participants (5 participants from each participating school), were invited to take part in these additional study measures, and are reported here. The sample size was based on feasibility of data collection and the resources available to the research team. If the selected children did not wish to participate in the sub-ample measures another participant was randomly selected from the volunteers in the school using the random number generator function in SPSS V.17 (SPSS Inc., Chicago, IL.) This sampling approach was completed until parental consent and participant assent was received for 60 participants to take part in the subsample measures. The number of children invited to take part in the subsample vs the number agreeing to participate were not recorded. Approximately 95% of the children were of white British ethnicity, which is representative of the school age population in Wigan (45). Schools were randomised to an intervention (N = 6 schools) or control condition (N = 6 schools) prior to baseline measures being completed in October 2010. Randomisation occurred prior to baseline measures to allow enough time for the teacher training sessions to take place, and was completed using the random number generator function in SPSS v17 (SPSS Inc., Chicago IL). Post intervention measures were completed after the 20 week intervention period in March and April 2011 for all measures with the exception of DEXA assessed body composition, which was assessed at baseline and follow up only. Follow up laboratory measures were taken 8 to 10 weeks after the intervention ended, prior to the school summer holidays in June-July 2011. One intervention school withdrew from the CHANGE! project shortly after baseline measurements leaving a subsample of 30 children in the control group, and 25 in the intervention group (total N = 55, N = 24 boys, 31 girls).

Intervention Design

The CHANGE! Intervention including details on lesson topics has been described elsewhere (14). Briefly the CHANGE! Intervention was designed and adapted from the Planet Health resources that have been used in the USA (19). The adaptations were made following formative work which has been described elsewhere (9, 29). The CHANGE! topics were aligned with the UK Healthy Schools programme and were cross-referenced to English National Curriculum objectives in Personal Social Health and Economic Education (PSHE) PE, Maths, Science, ICT, English, Geography and History (35). In total the CHANGE! Intervention consisted of 20 lesson plans which included worksheets, and other resources, and were also supported by homework tasks which involved the whole family, since the formative work emphasised the importance of family support. The CHANGE! lesson themes, titles and content summary have been published previously (14). Briefly themes such as energy balance, reducing sedentary time, what physical activity is and where children are active were amongst the topics covered.

Outcome Measures

Anthropometrics

Stature and sitting stature were measured to the nearest 0.1 cm and body mass to the nearest 0.1 kg using a stadiometer (Seca, Bodycare, Birmingham, UK) and calibrated electronic scales (Seca, Bodycare, Birmingham, UK) using standard techniques (28). Body Mass Index (BMI) was calculated using the equation body mass (kg) ÷ height $(m)^2$. Waist Circumference (WC) was measured using a non-elastic anthropometric tape. Measurements were taken at the narrowest point between the bottom of the ribs and the iliac crest by one researcher.

Body Composition

Body composition was assessed at baseline and follow up using fan beam dual energy x-ray absorptiometry (DEXA) (Hologic QDR series, Delphi A, Bedford, Massachusetts, USA) in the whole body scan mode. Participants were scanned in a supine position in lightweight clothing and without shoes. All scans were carried out by the same qualified researcher and were analysed using Hologic QDR software for Windows version 11.2. All scans were completed in accordance with standard operating procedures and after completing the necessary quality control checks including daily calibration. Key variables assessed from the whole body scan were absolute (kg) fat mass and lean tissue mass, and relative (%) body fat. Segmental analysis was also carried out to assess the distribution of body fat and the key variables of interest were trunk fat mass, and relative (%) trunk fat, peripheral (arms and legs) fat mass (PFM), and relative (%) peripheral fat.

Somatic Maturation

Somatic maturation was estimated using the sex specific regression equations (32) by determining years from peak height velocity. This method has been used previously in similar paediatric populations (20, 25) and shows acceptable agreement with skeletal age (32).

Estimation of Deprivation

To account for the known associations between deprivation and health outcomes, postcodes for the primary address of each participant were collected and indices of multiple deprivation score (IMD) were calculated using Geoconvert (http://geoconvert.mimas.ac.uk/) which uses data from the National Statistics Postcode Database November 2010. The IMD score was then retained for analysis.

Cardiorespiratory Fitness (VO_2peak)

Peak oxygen uptake (VO_2peak) was assessed using an individually calibrated continuous incremental treadmill (H P Cosmos, Traunstein, Germany) test to volitional exhaustion, under ambient conditions, using an online gas analysis system (Jaeger Oxycon Pro, Viasys Health Care, Warwick, UK). All participants wore an accelerometer (Actigraph GT1M, ActiGraph LLC, Pensacola, FL, USA) on the right hip and a heart rate monitor (Polar, Kempele, Finland) throughout the test. In order to account for individual variation in limb length, the VO_2peak test speeds were calibrated individually by setting treadmill speeds to set Froude (Fr) numbers. Dynamic similarity theory suggests that geometrically, individuals will have similar gait dynamics if the Fr number is kept constant (1). According to this theory optimum walking speed will be at Fr 0.25, with the transition between walking and running occurring close to Fr 0.5 regardless of variations in body size (31). Therefore treadmill speeds were calculated individually using the equation:

$$Fr = v^2 / (g \times l)$$

[Where v is speed of movement (m/sec), g is gravity, l is leg length (m)]

The protocol involved 2 minute incremental stages; stage 1 was programmed to individual walking speed equivalent to Fr 0.25; stage 2 was programmed to a speed equivalent of Fr 0.5; subsequent stage increments were based on researcher judgement using respiratory exchange ratio (RER) and heart rate (HR) of participant as a guide and either involved an increase in speed, determined by the difference in speed for stages one and two (approximately 1 to 2 km/h), or by an increase in gradient. VO_2peak was determined as the highest 15-s averaged oxygen uptake achieved during the test when participants exhibited subjective indicators of peak effort that were confirmed by a RER $\geq$ 1.05 and/or HR $\geq$ 195 beats·min^{-1}. This protocol has been used previously in similar paediatric studies (10, 24).

Statistical Analysis

All analyses were conducted using SPSS V.17 (SPSS Inc., Chicago, IL.). Participant characteristics were compared at baseline using multivariate analysis of covariance (MANCOVA) controlling for sex and IMD. Differences in mean waist circumference, BMI Z-scores, body composition measures and VO_2peak between participants in the intervention and control groups at each time point were assessed using MANCOVA with somatic maturation, IMD and sex as covariates. Change scores between baseline and post intervention and baseline and follow up were calculated for waist circumference, BMI Z-scores, body composition measures (baseline and follow up only) and VO_2peak. Group differences between mean change scores were assessed using MANCOVA with sex, somatic maturity at baseline, IMD, and baseline measure value as covariates. This method has been recommended for use in randomised control trials (RCTs), and generally has greater statistical power than other methods when analysing the effects of RCTs (44). Partial eta squared (η^2) values provide estimates of effect sizes for the main analyses where partial $\eta^2 \geq 0.01$, 0.09 and 0.25 classified as small, medium and large effect sizes respectively (33).

Results

Participant characteristics are presented for the control and intervention groups in Table 1. Groups were well matched at baseline. Table 2 shows adjusted means (SD) for measures at baseline, post intervention and follow up. For the comparison of mean values between groups, there were no significant differences for any values at post intervention. There were also no significant differences for any values with the exception of significantly lower trunk fat mass (control group 4.7 kg, intervention group 3.1 kg, $p = 0.041$, partial $\eta^2 = 0.098$, medium effect size) and trunk fat mass % in the intervention group in comparison to the control group at follow up (control group 23.08%, intervention group 17.75%, $p = 0.022$, partial $\eta^2 = 0.122$, medium effect size). Table 3 displays adjusted mean change scores between baseline and post intervention, and between baseline and follow up, when controlling for baseline values, sex, maturity, and IMD. For the change score analysis there were no significant differences between groups for baseline to post intervention change scores. A significant difference between groups for waist circumference change between baseline and follow up was observed after controlling for sex, maturity, baseline values, and IMD (control waist circumference change: 0.013 cm, intervention change score: -0.002cm, $p=0.023$, partial $\eta^2 = 0.166$, medium effect size) (Table 3). There were no other statistically significant differences between groups for changes between baseline and follow up for any of the other measures.

The adjusted body composition (DEXA) measures showed favourable improvements in the intervention group in comparison to the control group in a range of measures (Tables 2 and 3); however, none of these changes with the exception of mean trunk fat and trunk fat% reached statistical significance ($p > 0.05$). Whole body fat mass decreased by 0.31 kg in the intervention group and increased by 1.84 kg in the control group (partial $\eta^2 = 0.096$ medium effect size), and whole body fat % reduced in the intervention group by 0.68 %, whereas the control group increased by 2.04 % (partial ŋ2 = 0.095, medium effect). There was a slight decrease in trunk fat mass of 0.26 kg in the intervention group, and an increase of 1.02 kg in the control group (partial η^2= 0.024, small effect). Trunk fat % reduced in the intervention group by 1.32 % and increased by 2.6 % in the control group, however this change score trend did not reach statistical significance (p = 0.091, partial ŋ2= 0.022, small effect). Peripheral fat mass also decreased slightly in the intervention group (0.04 kg) and a small increased was observed in the control group (0.80 kg, partial ŋ2= 0.008, negligible effect). Peripheral fat mass % decreased by 0.33% in the intervention group and increased by 2.22% in the control group (partial η^2 = 0.042, small effect). Whole body lean mass % increased in the intervention group slightly (0.68%) in comparison to a small decline in the control group (-2.04%), however this trend was not statistically significant (p = 0.268, partial η^2= 0.012, small effect). Between baseline and post intervention the control group exhibited greater changes in VO_2peak (4.1 ml/kg/min) than the intervention group (2.37 ml/kg/min). Despite this, the intervention group exhibited a greater increase in VO_2peak between baseline and follow up (5.25 ml/kg/min) in comparison to the control group (2.87 ml/kg/min) however this difference did not reach statistical significance (p=0.410, partial ŋ2= 0.042, small effect).

Discussion

This cluster randomised study aimed to assess the effects of the school-based CHANGE! PA and healthy eating intervention on body composition and cardiorespiratory fitness in a sub-sample of 10 to 11 year old children. A significant intervention effect was detected at follow up for adjusted mean waist circumference change scores, mean trunk fat mass and trunk fat %. Furthermore, there were also favourable improvements in body composition (DEXA) measures in the intervention group in comparison to the control group (Tables 2 and 3);

however, none of these changes reached statistical significance ($p > 0.05$), which may be due to the small sample size involved in the sub-sample cohort. Despite the lack of statistically significant findings, medium and small effect sizes were observed that suggested the intervention may have been beneficial.

The results of the present study add a degree of support to the existing evidence of the effectiveness of combined curriculum based PA and nutrition interventions on lifestyle-related health outcomes. The changes observed in mean trunk fat (mass and %) and waist circumference suggest reductions in central adiposity in the intervention group. Waist circumference and DEXA assessed trunk fat predict visceral fat (11, 41) and are positively associated with cardiometabolic risk factors in children (5, 39). The small to medium improvements in central adiposity observed, equating to a change score difference of 1.5cm between the control and intervention group at follow up, may be associated with reduced disease risk therefore representing an important intervention effect. Significant differences in waist circumference were also observed between the intervention and control groups in the main CHANGE! trial, however these improvements were statistically significant at post intervention only. Other physical activity and dietary intervention studies have reported improvements in waist circumference, for example the Lekker Fit! (26) study conducted with 9-12 year old children reported significant improvements in waist circumference in the intervention group, however their reported decrease in waist circumference was greater at 0.71 cm (26). Unlike the main CHANGE! study, no significant changes in BMI Z-scores were observed between the intervention and control groups either at post intervention or follow up, though the intervention group exhibited smaller Z-score changes between baseline and follow up (0.01 Z-score units) than the control group (0.48 Z-score units, partial $\eta^2 = 0.056$, small effect), suggesting favourable changes in the intervention group in overall body size, though these did not reach statistical significance. Other intervention studies have demonstrated significant improvements in BMI z-scores, with significant decreases in intervention children's BMI z-scores (0.2 units) observed after two years follow-up in the APPLE Project (42), and in the Planet Health intervention study obesity prevalence significantly reduced in girls (19). Any reduction in BMI z-scores is thought to be clinically meaningful (6), reducing the risk of cardiometabolic disease (22, 23), therefore despite the lack of statistical significance the medium effects observed for BMI z-scores may have been meaningful in our study.

Despite differences in other measures of body size and body composition failing to reach statistical significance small and medium effect sizes demonstrate potentially beneficial changes in total body fat and peripheral fat mass between groups at follow up. These findings suggest that the CHANGE! intervention may have improved body composition, but that the sub-sample study was not suitably powered to detect changes. Future studies should aim to include larger sample sizes in all key outcome measures to better examine the effect of the intervention on body composition. Despite this recommendation, the use of DEXA in children's studies on a large scale is not always feasible, due to a lack of facilities and resources available.

When assessing change in VO_2peak from baseline to follow up the control group slightly increased VO_2peak (adjusted mean (SE) change = 2.87 (1.7) [95% CI -2.8, 4.2] ml/kg/min), whereas the intervention group increased VO_2peak by over 5 ml/kg/min. The difference in VO_2peak between groups did not reach statistical significance ($p = 0.410$). Other studies have demonstrated greater increases in fitness immediately following multi-disciplinary curriculum based interventions (27, 30, 38), however, fitness was assessed using different methods to CHANGE!. The small improvement in VO_2peak in the intervention group between baseline and follow up equates to an increase of 2.8%, representing a small effect size. In a review of 22 aerobic training studies, there was an average improvement in VO_2peak of 5-6%, and greatest improvements were evident where training intensity exceeded 80% HR max (4). In light of this, the improvement in the present study is low, and suggests that any changes in physical activity were not of sufficient intensity or duration to stimulate significantly improved fitness. Despite the minor intervention effects observed, cross sectional studies have demonstrated the negative relationship between clustered cardiometabolic risk and VO_2peak (3, 10, 17) and therefore the small improvement in VO_2peak observed in the current study, if sustained, may be physiologically beneficial.

The CHANGE! intervention was underpinned by a programme of formative work (9, 29) as well as reviews of empirical evidence related to school-based physical activity and nutrition interventions. Empirical evidence consistently reported that multi-component studies stood the best chance of success and formative work highlighted key issues of importance to the target population. The theoretically underpinned curriculum intervention that was adjusted to the needs of the population involved (9, 29) in combination with homework tasks to promote family engagement (13) may have created an environment conducive to behaviour change, thus accounting for the changes observed in body composition and body size observed. In the absence of a thorough process evaluation it is difficult to establish which components of the CHANGE! intervention were successful or unsuccessful, therefore future studies should build-in thorough process evaluation measures to provide this important information going forwards.

Strengths and Limitations

Over 75% of children invited to take part in the main CHANGE! study consented to take part, and the subsample was randomly invited to participate from this group, therefore reducing the risk of sampling bias. Despite this, records were not kept to examine how many participants declined to participate in the subsample groups, so recruitment rates cannot be calculated. Randomisation into treatment groups was by school therefore reducing risk of intervention contamination to control group children, however randomization occurred prior to baseline measures. The intervention content was informed by opinions and beliefs of the participants and stakeholders and was relevant to the local context. Furthermore, the intervention was a sustainable approach since existing class teachers delivered the lessons, which were able to be integrated into the existing curriculum. Randomisation into treatment group was limited to clusters (by school) and therefore allows for the possibility of clustering of outcome observations within schools. However, at baseline control and intervention participants were well matched and analysis of the main CHANGE! intervention study found no significant influence of clustering on outcomes. Statistical analysis presented within the present study controlled for baseline results, as well as sex, deprivation (IMD), and maturation therefore accounting for the influence of these covariates within analyses.

Teachers received training on how to deliver the intervention lessons; however, there were no on-going procedures in place to monitor progress or to evaluate delivery of lessons, therefore intervention fidelity is unknown. The study used reference standard measurement techniques to assess body composition (DEXA), and CRF (individually calibrated treadmill based VO_2peak protocol). In larger scale studies the combination of such high quality measures are rarely utilised. However, the sample size for the subsample was relatively small. This would have therefore reduced statistical power and may account for some between group and time-point differences failing to reach statistical significance; furthermore, due to the small sample size and narrow age range of participants, the results may not be generalised to a wider population. This study demonstrates that conducting reference standard measures in children is possible and feasible, however a larger sample size is needed in future to obtain the necessary statistical power to detect any changes in health outcomes. A strength of the study was that it included a follow up investigation period. However, this was relatively short (8 to 10 weeks) and a longer term follow up is required to determine whether any intervention effects were maintained long-term.

Conclusions

The present study demonstrated short-term positive intervention effects with statistically significant improvements in waist circumference, mean trunk fat mass and mean trunk fat mass % at follow up. Given the association between central adiposity and disease risk, these changes are likely to be beneficial. The study also demonstrated some small to medium improvements in other markers including whole body fat %, lean mass % and VO_2peak at follow up. Since the CHANGE! intervention focused mainly on behaviour change, it is possible that any behavioural changes may not have clinical influence immediately after intervention. Therefore a similar study involving a greater number of participants and longer term follow up is required in order to establish if behaviour can transition into clinical health benefits using the CHANGE! intervention approach.

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Tables

Table 1. Participant characteristics at baseline adjusted for sex and IMD

	Control N= 27		**Intervention** N= 26	
	mean	(SE)	mean	(SE)
Age	10.62	(0.06)	10.64	(0.06)
Somatic Maturation (Years)	-1.99	(0.08)	-199	(0.08)
Stature (m)	1.46	(0.01)	1.45	(0.01)
Sitting Stature (m)	0.72	(0.007)	0.73	(0.007)
Mass (kg)	39.9	(1.5)	37.5	(1.5)
BMI (kg/m^2)	18.5	(0.53)	17.82	(0.54)
BMI z-scores	0.43	(0.2)	0.24	(0.2)
Waist circumference (cm)	63	(0.01)	62	(0.01)

BMI = Body mass index

Table 2 Adjusted mean (SE) and partial η^2 for waist circumference, BMI Z-score, and VO2peak at baseline, post intervention and follow up (where available), controlling for somatic maturation, IMD and sex

		Control N= 24		**Intervention** N= 22			
Variable	Time point	mean	(SE)	mean	(SE)	P Value	Partial η^2
Waist Circumference (CM)	Baseline	63.8	0.01	61.5	0.02	.286	0.028
	Post intervention	65	0.01	61.3	0.01	.074	0.076
	Follow Up	64.7	0.01	62.1	0.01	.212	0.038
BMI Z-score	Baseline	0.44	0.21	0.27	0.22	.581	0.008
	Post intervention	0.49	0.22	0.26	0.22	.459	0.013
	Follow Up	0.48	0.2	0.01	0.21	.128	0.056
VO_2peak (ml/kg/min)	Baseline	41.41	1.96	44.4	2.06	.320	0.024
	Post Intervention	46.49	1.12	45.66	1.17	.620	0.006
	Follow Up	44.61	1.7	49.26	1.78	.076	0.075
Whole Body Fat Mass (kg)	Baseline	11.34	0.88	9.62	0.93	.202	0.039
	Follow Up	12.69	1.11	9.84	1.16	.093	0.067
Whole Body Fat %	Baseline	26.34	1.29	24.3	1.35	.30	0.026
	Follow Up	27.98	1.42	24.05	1.49	.073	0.076
Trunk Fat Mass (kg)	Baseline	4.02	0.42	3.02	0.44	.117	0.059
	Follow Up	**4.72**	**0.51**	**3.11**	**0.53**	**0.041***	**0.098**
Trunk Fat %	Baseline	21.04	1.35	18.13	1.42	.159	0.048
	Follow Up	**23.08**	**1.49**	**17.75**	**1.56**	**.022***	**0.122**
Peripheral Fat Mass (kg)	Baseline	6.52	0.48	5.82	0.5	.334	0.023
	Follow Up	7.17	0.61	5.95	0.63	.187	0.042
Peripheral Fat %	Baseline	32.03	1.68	30.17	1.76	.462	0.013
	Follow Up	34.01	1.81	30.11	1.90	.159	0.048

Whole Lean Body Mass (kg)	Baseline	2.93	0.46	2.88	0.48	.470	0.013
	Follow Up	3.01	0.94	2.88	0.48	.935	0.000
Whole Lean Body Mass %	Baseline	73.67	1.29	75.70	1.35	.300	0.026
	Follow Up	72.03	1.42	75.95	1.49	.073	0.076

* denotes significant difference between control and intervention groups

Table 3. Change scores (SE) and partial η^2 between groups at all time points, controlling for sex, somatic maturation (baseline), IMD and baseline values

		Control N= 24		**Intervention** N= 22			
Variable	Time point	Change Score	(SE)	Change Score	(SE)	P Value	Partial η^2
Waist Circumference (cm)	Baseline to Post	1.1	0.5	0.4	0.5	.355	0.030
	Baseline to Follow Up	**1.3**	**0.4**	**-0.2**	**0.4**	**.023***	**0.166**
BMI Z-score	Baseline to Post	0.042	0.097	0.001	0.102	.792	0.002
	Baseline to Follow Up	0.042	0.096	0.002	.102	.796	0.002
VO_2peak (ml/kg/min)	Baseline to Post	4.10	0.90	2.37	0.95	.239	0.052
	Baseline to Follow Up	2.87	1.77	5.25	1.87	.410	0.042
Whole Body Fat Mass (kg)	Baseline to Follow Up	1.84	1.06	-0.31	1.12	.219	0.096
Whole Body Fat %	Baseline to Follow Up	2.04	1.50	-0.68	1.58	.268	0.095
Trunk Fat Mass (kg)	Baseline to Follow Up	1.02	0.45	-0.26	0.48	.090	0.024
Trunk Fat %	Baseline to Follow Up	2.60	1.5	-1.32	1.58	.091	0.022
Peripheral Fat Mass (kg)	Baseline to Follow Up	0.80	0.61	-0.04	0.65	.402	0.008
Peripheral Fat %	Baseline to Follow Up	2.22	1.96	-.330	2.07	.425	0.042
Whole Lean Body Mass (kg)	Baseline to Follow Up	1.36	0.99	0.57	1.05	.623	0.000
Whole Lean Body Mass %	Baseline to Follow Up	-2.04	1.50	0.68	1.58	.268	0.012
BMC (kg)	Baseline to Follow Up	0.07	0.04	0.06	0.04	.925	0.024
BMD (g/cm^2)	Baseline to Follow Up	0.017	0.013	0.005	0.014	.565	0.048

*denotes significant difference between control and intervention group

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