# Exercise and Obese Youth – Facing Disease Together

**by Sonia Gunkel and Graduate Student Mentor, Jeremy Ducharme**

## Introduction

When caloric consumption chronically exceeds its expenditure, the outcome is obesity, a health condition causing about 30,000 yearly premature deaths (1, 2). Unfortunately, one can become obese or overweight even before adulthood. In general, 25 $kg/m^2$ and 30 $kg/m^2$ are the respective BMI cutoff values for overweight and obese youth ranging in age from 2 to 18 years (3). In addition to general BMI cutoffs (3), there are also sex and age-related criteria for defining overweight and obesity among children (4, 5). For example, the $85^{th}$ to $95^{th}$ BMI percentile and $\geq 95^{th}$ BMI percentile within children's age and sex-matched cohorts have been used as age and sex-based, overweight and obesity criteria (4, 5). Unlike adults, children need age-related BMI criteria since their BMI does not stay consistent throughout childhood (3). As for obesity onset, less than 5 years and greater than 15 years of age are considered the most harmful (1). Some possible causes of childhood obesity include societal structure, genetic predisposition, and socioeconomic status (1). Increased sedentary time and decreased physical activity, along with overfeeding, are also thought to help encourage childhood obesity (2). Regrettably, childhood obesity's prevalence is increasing quickly (6) with developed countries in 2013 having an overweight and/or obesity prevalence of 23.8% and 22.6% in boys and girls, respectively (7). Obesity's expansion has also been highly associated with youths' rising chronic disease prevalence (6, 8). Experiencing adulthood obesity is also more probable if a person is obese or overweight during childhood (3). Thankfully, exercise has demonstrated that it can help overweight and obese youth with chronic disease-related factors and body composition (3, 9, 10, 11). As a result, the purpose of this review is to identify the beneficial effects exercise has on body composition, metabolism, and risk of cardiovascular disease with overweight and obese youth. It will also examine the part that exercise plays in childhood obesity prevention. Exercise engagement by overweight and obese youth is needed so they can avoid adulthood obesity and chronic disease.

## Exercise and Body Composition

Body composition is an important obesity-related issue to address since obesity may hold children captive for a lifetime. In one study, adult obesity was the outcome for 26% to 41% of preschoolers who were obese and 42% to 63% of school-aged children who were overweight (1).

This outcome is not surprising considering that adulthood obesity onset and retention of this weight have a greater chance of occurring with obese youth (3). For example, subjects in one study who were obese as children according to left subscapular skinfold (LSSF), body mass index (BMI), LSSF plus BMI, or who were not obese as a child had 48.3%, 60.0%, 65.1%, and 13.4% as their respective adulthood obesity incidence (5). In addition, obese youth have been found to have a significantly higher BMI, visceral and abdominal fat mass, and body weight versus normal-weight youth (11). Thankfully, encouraging body composition changes have appeared with exercise. For example, obese adolescents' relative body fat percentage and BMI fell significantly after 6 months of high or low intensity aerobic exercise training (9). From a 12-week exercise program, not involving caloric restriction, a significant rise and a significant loss of lean mass and fat mass, respectively, also emerged with obese adolescents (11). An interdisciplinary intervention for obese adolescents, which lasted one year and included aerobic or aerobic plus resistance training, ended with a significantly greater decrease in subcutaneous fat, percent body fat, visceral fat, and fat mass in the aerobic plus resistance training group versus the aerobic training only group (8). Significant visceral fat reduction is crucial since chronic disease risk is possibly heightened by the higher proinflammatory cytokine secretion encouraged by too much visceral fat (8). In summary, by exercising, obese youth can not only improve their body composition, but also possibly lessen their chronic disease risk (8).

**Exercise and Metabolic Syndrome**

Obese youth need body composition improvement due to its relationship with chronic diseases such as metabolic syndrome. One study found adult metabolic syndrome risk was greater among subjects who were obese as children and as adults, as well as those who acquired obesity in adulthood (5). Adult metabolic syndrome risk was not foreshadowed, however, in the subjects who were obese as children, but not as adults (5). In another study, about a three times higher adult metabolic syndrome risk was related to subjects displaying the highest childhood waist circumferences within the study (12). In terms of metabolic syndrome criteria, obese children have displayed a lower level of plasma high density lipoprotein-cholesterol (HDL-c), as well as higher levels of triglycerides (TG) versus lean pediatric subjects, which is not ideal (4, 5, 12). Fortunately, metabolic syndrome criteria (5, 12) have changed for the better with exercise. In one study, the obese adolescents of the high intensity aerobic exercise training group experienced a significant decrease in waist circumference (9), showing that obese youths'

metabolic syndrome risk can be lowered with high intensity aerobic exercise (5, 9, 12). In addition, when a 12-week aerobic exercise program finished, obese pediatric subjects' triacylglycerol was significantly less than it was pre-exercise intervention (10). After taking part in an inpatient treatment program, which involved exercise, diet, and psychological interventions, obese adolescents also had a 5.0 ± 9.0 mg/dL rise in HDL-c (6). In short, by improving metabolic syndrome criteria such as waist circumference, triacylglycerol, and HDL-c, obese youth might be able to reduce their chance of developing metabolic syndrome.

**Exercise and Insulin Resistance**

In addition to adult metabolic syndrome, insulin resistance is another health issue that obese children can face. For example, children who have metabolic syndrome are subjected to a great risk of insulin resistance if they are obese (4). In fact, obese pediatric subjects in one study were significantly more insulin resistant than the lean pediatric subjects, manifested through significantly greater levels of insulin, homeostasis model assessment for insulin resistance index (HOMA-IR), and fasting glucose (4). Having insulin resistance as an obese child is also related to low levels of adiponectin and high levels of leptin and tumor necrosis factor-alpha (TNF-α), which are inflammatory cytokines (4). Interestingly, one study showed insulin resistance and adiponectin level demonstrating a negative correlation, while insulin resistance and leptin level demonstrated a positive correlation (4). Adult diabetes risk has also been increased in subjects whose BMI and LSSF or just LSSF as a child defined them as obese (5). Fortunately, exercise has been demonstrated to improve HOMA-IR and insulin (8, 10). For example, post aerobic exercise intervention, an obese pediatric group displayed levels of HOMA-IR and insulin that were significantly less than they were pre-exercise intervention (10). Obese adolescents in aerobic training as well as aerobic plus resistance training groups have also displayed significant post-intervention decreases in their HOMA-IR and insulin levels (8). These findings show that aerobic and aerobic plus resistance training can help lessen obese youths' insulin resistance (4, 8, 10). In addition, an intervention group's adiponectin level was able to increase significantly by the time its inpatient treatment program finished (6), indicating yet another way obese youths' insulin resistance may be reduced (4). As a whole, by decreasing insulin resistance, obese youths' metabolic health can improve (4).

**Exercise and Cardiovascular Disease**

One cardiovascular disease-related issue that obese youth can face is systemic inflammation. High-sensitive C-reactive protein (hsCRP), Soluble Tumor Necrosis Factor-α Type II Receptor (sTNFα-rII), interleukin-1 receptor antagonist (IL-1Ra), and TNF-α have been higher in obese adolescents, revealing low-grade inflammation (11). In addition, a pro-inflammatory state has been evident in obese children with their levels of TNF-α, hsCRP, and monocyte chemo-attractant protein-1 (MCP-1) greater in comparison to lean children's to a significant extent (4). Inflammation is not ideal, however, since the process of atherosclerosis depends on it (4). Additionally, according to Chang, Jian, Lin, Zhao, Ho, and Juan, cardiovascular disease's pathogenesis and progression are associated with inflammatory marker levels including TNF-α, hsCRP, and interleukin-6 (IL-6) (4). Insulin resistance, cardiovascular disease, inflammation, and obesity also have the adipokines, visfatin, retinol binding protein 4, leptin, and resistin, at work within them (10). Thankfully, although one study's obese pediatric group had significantly greater pre-exercise intervention levels of these adipokines than the control group, at post-intervention, these adipokine levels had fallen significantly (10). IFN-gamma-inducible protein 10 (IP-10), a chemokine, and IL-1Ra also became significantly less in the obese adolescents of another study post-exercise training, demonstrating a better inflammatory profile (11). In short, although obese youth can already have low-grade inflammation, decreasing their inflammation through exercise is possible, and perhaps could make them less likely to experience cardiovascular disease.

**Exercise and Childhood Obesity Prevention**

Thankfully, despite the numerous health problems that childhood obesity relates to, there are ways to prevent it. Specifically, obesity prevention relies most heavily on physical activity and diet (1). For example, childhood obesity prevention needs the building of play areas, parks, and walking paths since childhood weight loss is more attainable when children have places to exercise (1). Lowering children's sedentary time, such as by shortening their TV time, is also important for avoiding obesity (3). For physical activity, 30 of the 60 total minutes of physical activity youth need every day ought to be structured, while children of preschool age need unstructured physical activity (3). However, as Han, Fu, Cobley, and Sanders present, some physical activity obstacles that obese and overweight youth face are poorer motor coordination (MC) and fundamental movement skills (FMSs) (7). In fact, these authors explain that these youths' chances of gaining weight are higher since their physical activity engagement is lower

due to the inverse relationship MC and FMSs have with obesity (7). However, the motor coordination and fundamental movement skills of these youth are further harmed when they do gain weight (7). Interestingly, Han, Fu, Cobley, and Sanders propose that obese and overweight youth might be able to escape this cycle by increasing their MC and FMSs (7). Fortunately, through their research, these authors did find that it is possible for obese and overweight youths' motor coordination and fundamental movement skills to improve by engaging physical activity and regular exercise (7). In summary, physical activity and exercise might help prevent obesity from developing further, as well as potentially prevent childhood obesity altogether.

**Conclusion**

In conclusion, the body composition, metabolic health, and possibly risk of cardiovascular disease held by obese youth appear to improve following an exercise intervention. These improvements are critical since obese youth can already have systemic inflammation (4, 11) and insulin resistance (4). In addition, timely exercise interventions to prevent childhood obesity should be implemented since childhood obesity can put children in danger of developing adult obesity (5, 3, 12), metabolic syndrome (12), and diabetes (5). In terms of childhood obesity prevention, exercise can enter the scene via acquisition of better motor coordination and fundamental movement skills (7), being more physically active (3), and the creation of environments where children can play (1, 3). By implementing an exercise intervention, childhood obesity can be prevented, and the health of obese children can be improved.

**Additional Elements**

**Apply It!**:

Prescribing exercise for obese pediatric clients can be considered for decreasing their systemic inflammation, and possibly reducing their cardiovascular disease risk.

Exercise can be prescribed to ameliorate body composition measures in obese pediatric clients such as visceral fat, waist circumference, subcutaneous fat, BMI, and relative body fat percentage.

Obese pediatric clients who show insulin resistance should be prescribed exercise to increase their adiponectin level, as well as to decrease their levels of HOMA-IR and insulin.

**Bridging the Gap**:

Children who are obese can already possess insulin resistance and systemic inflammation, and could face obesity, metabolic syndrome, and diabetes in adulthood. However, studies have

revealed that obese youths' body composition and metabolic health can be improved, and their risk of cardiovascular disease possibly reduced from engaging in exercise interventions. Obesity onset in youth might also be avoided by exercising, which can decrease their risk of developing these obesity-related complications.

**Summary Statement**:

Exercise can help obese youth improve their body composition and metabolic health, lessen their chances of obesity, metabolic syndrome, and diabetes when they are adults, and possibly decrease their cardiovascular disease risk. It can also help prevent obesity onset which would put youth at a lower risk of experiencing obesity-related complications.

**Pulled text**:

When caloric consumption chronically exceeds its expenditure, the outcome is obesity, a health condition causing about 30,000 yearly premature deaths. Unfortunately, one can become obese or overweight even before adulthood.

**Bio:**

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