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Children with severe burn injury display no sex differences in exercise capacity at hospital discharge or adaptation after exercise rehabilitation training

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Abstract

Background and objective—Females have a 50% increased risk of death from burn injury compared to males. However, whether exercise capacity and exercise induced training adaptations differ between burned boys and girls is unknown. This project tested the hypothesis that girls with burn injury would have lower exercise capacity and different exercise induced training adaptations.

Methods—Twenty-five girls were matched to 26 boys (mean, 95%CI; years 13[12,14], cm 151[143,161], kg 54[45,63]; each $P>0.05$) for burn injury (% total body surface area burn, 54[45.62]; $P=0.82$). Lean body mass (LBM), strength (peak torque) and cardiorespiratory fitness (peak VO_2) were normalized to kg LBM and compared as a percentage of age-sex matched non-burned children (n=26 boys, years 13[12,14]; n=25 girls, years 13[12,14]) at discharge (DC) and after aerobic and resistance rehabilitation exercise training (RET).

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Thank you,
Eric Rivas

Results—Using a 2-way factorial ANOVA (group × time), we found both groups had similar 11% change in LBM (87.3% of non-burned values [82.2,92.3]) and after the RET (92.8% [87.2,98.3]; Main effect, time $P<0.0001$). Peak torque increased similarly by 16% in both groups (% of age-sex matched non-burned DC, 55.9[51.3,60.5]; after RET, 77.5[72.1,82.9]; Main effect, time $P<0.0001$). Likewise, peak VO_2 increased in both groups by 15% (% of age-sex matched non-burned DC, 56.8[52.4,61.2] to RET, 72.2[67.6,76.8]; Main effect, time; $P<0.0001$). Burned children exercise at greater percentage of their peak VO_2 and peak HR compared to non-burned children (Interaction, group x time, $P<0.0001$).

Conclusion—The burn injury does not have sex-dependent effects on LBM or exercise capacity in severely burn injured children. Differences in relative peak VO2 and peak HR suggest the need for burn specific exercise programs for improving the efficacy of a rehabilitation.

Keywords

Gender difference; burn trauma; aerobic; strength; body composition

Introduction

Thermal burns are a leading cause of preventable hospitalization and accidental death worldwide [1]. An estimated 265,000 deaths are caused by burns each year and have an economic impact of $211 million. According to the World Health Organization, females and males have similar rates of burn injury [1]; however, the American Burn Association has reported that burns affect 69% of males and 32% of females [2]. Notably, children are at greater risk of burn injury because of differences in body morphology. The head and neck are much larger in children than adults, and children have about three times the body surface area-to-body mass ratio of adults. Children are also thought to sustain burn injury in only a quarter of the time as adults [3,4], possibly leading to more severe injury. Studies show that boys are more likely to experience a burn injury than girls, possibly because of behavioral differences [5,6]. Moreover, in children, the severity and outcome of burn injury vary by age, region, income category, and sex [1,2,7]. Evidence suggests that sex differences in mortality exist after burn injury, with females having a greater risk of death in all age groups from 10 to 70 years old [8–10]. Why this difference exists is not clear, although female sex hormones may play a role [8–11]. Jeschke et al. found no differences in mortality between burned boys and girls but did observe sex differences in the inflammatory and hypermetabolic response [12,13].

Advances in the treatment of severe burns have improved survival; however, greater survival has been accompanied by body composition changes as well as metabolic and cardiovascular complications. All can last up to 3 years postburn, diminish physical capacity and quality of life, and contribute to mortality in burned children [14–16]. We have shown that, at hospital discharge, cardiorespiratory fitness and strength are lower in burned children than nonburned healthy children and that rehabilitation exercise training improves these measures of physical capacity [17–21]. Although studies have shown exercise training to be beneficial, whether body composition, exercise capacity, and adaptations to exercise training differ between boys and girls is unknown. Therefore, we investigated the effect of a rehabilitative exercise training (RET) program on body composition, strength, and cardiorespiratory fitness in burned boys and girls. We hypothesized that sex differences would be present in RET adaptations related to body composition, strength, and aerobic exercise capacity.

Methods

Study design

This was a retrospective study approved by the University of Texas Medical Branch IRB in which children with burn injury were matched with respect to age and total body surface area (TBSA) burned (see Table 1). A large database at Shriners Hospitals for Children (Galveston, TX) was queried for patients who were admitted from 2005 to 2016 and who met the following inclusion criteria: 7–18 years of age, 30% or greater TBSA burned, and completion of a 6- or 12-week RET program. All patients provided written informed consent and completed a concurrent aerobic and resistance RET program that was dependent on burn severity (6 weeks for > 30–59% TBSA burns and 12 weeks for > 60% TBSA burns). All underwent testing for body composition, exercise strength, and aerobic capacity both before and after RET. Data for nonburned healthy children collected between 2001 to 2017 were also obtained from the database. All were volunteers in the Galveston community. Each burned child was matched to a nonburned child for sex and age. The nonburned child did not complete RET and was used only as a nonburn reference for body composition, strength, and cardiorespiratory fitness.

Rehabilitative exercise training

RET began at discharge from the intensive care unit, when burn injuries were at least 95% wound healed. Aerobic and resistance exercise training was supervised by an American College of Sports Medicine-certified exercise specialist. The RET regimen consisted of alternating resistance and aerobic exercise training up to 5 days per week. Aerobic exercise consisted of 3 to 5 sessions per week of training on a treadmill, stationary bicycle, or cycle arm ergometer. Patients exercised at 60 to 85% of the peak heart rate for 20 to 40 minutes (5 metabolic equivalents at ~75% of the volume of peak expired oxygen) for at least 150 minutes per week. Resistance exercise intensity was determined by the 8 to 12 repetition maximum of the participant (volume loads: reps × sets × weight of 280 for the upper body and 590 per day). The strength training component consisted of at least 3 sessions of 8 varying basic resistance exercises including toe raises, leg extension, bench press, shoulder press, leg press, bicep curls, tricep curls, and leg curls. Strength exercises were completed using free weights or variable resistance machines. Weight was progressively increased over time. Exercise training typically began with a 10-minute aerobic warmup and ended with an aerobic cool down.

Body composition

Body composition was determined using dual X-ray absorptiometry (DXA, Hologic model QDR-4500-W, Hologic, Inc., Marlborough, MA, USA). Subjects underwent low-energy whole-body X-ray scans using pediatric software for the measurement of lean body mass (LBM) and fat mass. The DXA instrument was calibrated using the manufacturer's suggested procedures.

Strength assessment

Muscle strength in the dominant leg was assessed using isokinetic dynamometry via the Biodex System 4 dynamometer (Biodex Medical Systems Inc., Shirley, NY). Peak torque and average power were measured during a 150-degree extension at the knee joint. All subjects were familiarized with this procedure before each test using visual and verbal explanations.

Cardiorespiratory fitness

Peak oxygen consumption/uptake (VO_2) was determined using a modified Bruce protocol treadmill test. The test consisted of 3-minute stages in which speed and incline were progressively increased. Expired gases were measured and recorded until patients reached volitional fatigue. Expired gases were analyzed by indirect calorimetry (MedGraphics Cardi O2 metabolic cart, St. Paul, MN, USA). Gasses and air flow were calibrated using known gasses (O_2 and CO_2) and a 3 L syringe prior to each test. Subjects were considered to have reached peak VO_2 when they signaled to stop and met 3 of the following criteria: a respiratory exchange ratio ≥1.05, a leveling off in VO_2 with increasing workloads (< 2 ml kg min^{-1}), final heart rate ≥190 bpm, or a final test time of 8 to 15 minutes.

Statistical methods

Unpaired t-tests were performed to compare demographics between burned boys and girls. An ordinary ANOVA was used where appropriate to compare demographics between burn and nonburn groups. Two-way (group × time) ANOVA was performed for body composition and exercise variables for main effects and interactions. Post hoc testing was performed using Sidak's multiple comparisons test. To control for growth and body morphology variations between boys and girls, we normalized VO_2 to LBM or expressed it as a relative percentage of age- and sex-matched nonburn values. To control for baseline differences, we calculated the relative change from pre- to post-RET [(pre-post RET) ÷ pre RET]. Submaximal VO_2 and heart rate were obtained during the first 4 stages of the cardiorespiratory fitness test (modified Bruce) and were compared as a relative percentage of peak values. Data were analyzed and figures generated using GraphPad Prism (Version 6.0, La Jolla, CA, USA), with significance set at $P < 0.05$. All data are reported as mean ± 95% CI.

Results

Physical characteristics at discharge

Physical characteristics of burned subjects at discharge and nonburned subjects are presented in Table 1. All subjects were matched for age, height, and weight. Burned boys and girls had similar TBSA burned and TBSA third-degree burns. Burn type was also comparable between groups. Subjects had flame (69% boys, 68% girls), electrical (21% boys, 15% girls), or scald burns (3% boys, 3% girls), with inhalation injury being present in 7% of boys and 15% of girls. Hospital stay was longer for girls than boys (41 ± 23 vs.29 ± 13 days, $P =$ 0.02). Subjects received medications as part of other studies, and these included propranolol (17% boys, 27% girls), oxandrolone (37% boys, 7% girls), oxandrolone with propranolol

(3% boys, 13% girls), metformin (7% boys, 10% girls), fenofibrate (0% boys, 3% girls), growth hormone (17% boys, 7% girls), and placebo (20% boys, 33% girls).

Burn- and RET-induced body composition changes in boys and girls

Analysis of body composition before RET (discharge) and after RET revealed that absolute LBM was 16% lower in girls than boys at both times (main effects for time and sex, $P \leq 0.025$; Figure 1A). However, both groups had a similar relative increase in LBM of 6% (95% CI, 4.1 to 7.3%; $P = 0.86$) from pre- to post-RET (Figure 1B). Relative to age- and sex-matched nonburned children, both groups had ~13% less LBM at discharge (87.3% of nonburned values [82.2 to 92.3%]) and ~7% less LBM after RET (92.8% [87.2 to 98.3%]; main effect, time, $P < 0.0001$; Figure 1C). Burned girls had 4 kg more absolute fat mass than boys at discharge and after RET, with girls' absolute fat mass remaining comparable from pre- to post-RET (2.2% [−4.6 to 8.9%]. On the other hand, boys had a pre- to post-RET fat mass increase of 14% [5.4 to 23.5%] ($P = 0.017$; Figures 1D, 1E). Relative to their nonburned counterparts (Figure 1F), boys had 12% more fat mass at discharge and girls 21% more (boys 111.5% [89.1 to 133.8%], girls 120.7% [102.3 to 139.1%]). After RET, boys had even greater fat mass (~17% more) than nonburned counterparts, while girls maintained fat mass (boys 128.1% [100.2 to 156.1%], girls 121.4% [103.9 to 138.9%]; interaction, time × group, $P < 0.0001$).

RET improves peak muscle strength and cardiorespiratory fitness similarly in burned boys and girls

Peak torque normalized to kilograms of LBM (Figure 2A) or expressed relative to age- and sex-matched nonburn values (Figure 2C) did not differ between groups (both analyses, main effect, time, $P < 0.0001$. Likewise, peak torque improved to the same degree from pre- to post-RET in both groups (28% increase [24.2 to 31.9%], $P = 0.94$; Figure 2B). Analysis of cardiorespiratory fitness revealed that LBM-normalized peak VO_2 was lower in girls than boys both before and after RET and that it was improved by RET in both groups (main effects for time and sex, $P \leq 0.036$). However, when controlling for sex differences, we found that the relative improvement from pre- to post-RET did not differ between boys and girls (21.2% change [17.5 to 24.8%], $P = 0.28$). Peak VO_2 expressed as a relative percentage of age- and sex-matched nonburn values also improved from pre- to post-RET (main effect for time, $P < 0.0001$).

RET improves submaximal VO_2 similarly in burned boys and girls

Oxygen uptake during each stage of the modified Bruce treadmill test did not differ between burned boys and girls; therefore, the data were combined. As shown in Figure 3A, submaximal VO_2 was comparable among the pre-RET, post-RET, and nonburn groups during the first 4 stages of the test. However, peak values (final stage) differed from pre- to post-RET and between burn and nonburn groups (group × stage interaction, $P < 0.0004$). During the first 4 stages, percent peak VO_2 (VO_2 expressed as a percentage of peak VO_2 at discharge) was significantly greater before RET than after RET, with percent peak VO_2 being partially restored to nonburn levels after RET (Figure 3B).

RET improves the submaximal heart rate response in burned boys and girls

Sex differences in submaximal heart rate were present from pre- to post-RET for nonburned subjects; therefore, data were stratified by sex. For each of the 4 initial stages of the modified Bruce test, heart rate was greater in boys (Figure 4A) and girls (Figure 4C) than their nonburned counterparts both before and after RET, and RET reduced heart rate for each 4 stages (interaction, group × time, $P < 0.0001$). Percent peak heart rate (heart rate expressed as a percentage of peak heart rate at discharge) was greater in burned boys and girls than nonburned controls and was shifted down by RET closer nonburned values (Figure 4B, 4D).

DISCUSSION

The purpose of this study was to determine whether, after severe burn injury, sex differences exist in body composition, strength, and aerobic exercise capacity at discharge and after RET. Our results show that, compared to age- and sex-matched nonburned children, burned boys and girls have a similar relative LBM at discharge and experience an increase in LBM after RET. Unlike LBM, fat mass is elevated above nonburn levels in boys and girls and increases in only boys after RET. Strength and cardiorespiratory fitness are attenuated at discharge and similarly increased relative to age- and sex-matched non-burned children. Additionally, we found that submaximal oxygen uptake was not different in burned compared to non-burned at discharge or after a RET program. However, due to peak VO_2 differences, burned children work at a greater percentage of their peak VO_2 and after RET improves closer to non-burned values. Lastly, it seems that though heart rate response during submaximal exercise is greater and improved after RET in both groups. To our knowledge, we are the first to report that no sex differences exist for peak exercise capacity and exercise training-induced adaptations in a pediatric burn population. This is an important finding considering the utility of RET in improving LBM, strength, and cardiorespiratory fitness in burn populations.

Burn injury is accompanied by long-term metabolic and cardiovascular complications that can last up to 3 years postburn, reducing physical capacity and quality of life in burned children [14,15]. Recently, Duke et al. (2015) found that children with burn injury had long-term all-cause mortality, and females were found to have worse outcomes than males after burn injury [16]. In the present cohort of burned children, which was matched for TBSA burns and third-degree burns, females had a significantly longer acute care hospitalization. However, whether sex differences affect burn outcomes is still not clear.

The hypermetabolic response to burn trauma causes muscle protein catabolism that lasts up to 9 months postburn [22]. Our results are consistent with this prolonged catabolism and showed that, at discharge, burned children had significantly lower LBM than nonburned age- and sex-matched children. However, our results show for the first time that sex did not affect burn-induced loss of LBM or RET-induced improvements in LBM, as both groups had similar LBM at before and after RET. Others have reported that burn injury is associated with changes in fat mass for up to 6 to 12 months postburn [13,23,24]. Jeschke et al. found that, at 6 to 24 months postburn, no sex differences were present in body composition assessed as a percentage of total fat and LBM. Our data differ given that, at discharge and after RET, we determined total absolute values as well as values relative to those for nonburned age- and sex-matched children to further control for sex differences. Recently, we have found prolonged hospitalization from burn injury in children to have greater lean mass loss in the upper extremity and remodeling of the fat compartments from admittance to discharge [25]. Interestingly, we found that at discharge fat mass was increased and after exercise training fat mass was greater in boys than girls.

We are not entirely sure why there were differences in fat mass between boys and girls. We can only speculate that there the differences are due to fat metabolism at discharge and/or after exercise training responses that may be attributable to sex-dependent inflammatory and hypermetabolic responses [12,13]. We showed that at discharge, both boys and girls had greater relative body fat than age-sex matched nonburned children (boys 12% and girls 21% more fat mass than age-sex matched nonbuned children). This increased in boys to 28% of non-burned values while the girls remained that same. Two important observations from this that require further understanding are 1) why fat accumulation occurs greater in girls at discharge compared to boys, and 2) why do boys increase fat mass to a greater extent after rehabilitation exercise training compared to burned girls? All other variables were matched well (burn type, %TBSA, drug intervention, etc.); however, girls remained in hospitalization that was significantly longer than boys, and this may have affected girls' fat body composition at discharge, due to the prolonged bed rest in conjunction with the burn trauma. It is established that burn injury will affect fat metabolism which is associated with an increase in metabolic rates, whole-body catabolism, muscle wasting, and severe cachexia. Work from our institute has shown that propranolol attenuates splanchnic triacylglycerol storage [26]. Notably, only 20–30% of the study participants received propranolol. Further study should investigate if propranolol would affect body fat storage during ICU and with rehabilitation exercise post-discharge. For reasons currently unknown, the increases in lean mass after rehabilitation exercise is also accompanied by an increase in fat mass only in boys with severe burn injury. It is established that burn injury will increase lipolysis and hepatic fatty acid accumulation [26]. Further, we can only speculate that burn injury causes exercise metabolic changes in fat metabolism more so in boys than in girls, however, this requires further understanding and as we mentioned previously, the hospital stay length may have affected the fat differences at discharge. Burn injury is met with an aggressive nutritional intervention that attenuates the hypermetabolic response and reduces morbidity and mortality [27] and it may be possible that nutritional differences caused fat storage. An increase in fat mass, as we have reported previously, that occurs primarily in the truncal region and in the lower limbs during the intensive care unit[28] may have life-long consequences that may increase risk for developing type 2 diabetes mellitus and cardiovascular disease. Thus, further study on drug, exercise, and nutritional interventions at discharge and outpatient continued care are required to minimize the negative consequences of an accumulation of fat mass in burn patients.

This study is the first to investigate sex differences in exercise capacity and training adaptations in burned children. We found, in agreement with previous studies, that burns significantly attenuated strength to a similar extent in boys and girls and that strength did not differ according to sex in burned children. Both burned boys and girls had similar training improvements. This agrees with other studies showing no sex differences for anaerobic capacity or strength in children [29,30]. In general, girls tend to have lower cardiorespiratory fitness than boys when VO_2 is normalized to total body mass. Healthy nontrained boys and girls reportedly have a peak VO_2 of 47 ml O_2 kg min^{-1} and 40 ml $O_2 \cdot kg \cdot min^{-1}$, respectively [31]. However, given the differences in fat mass between groups, we normalized VO_2 to LBM and found that burned girls have lower cardiorespiratory fitness than boys. When compared to age- and sex-matched nonburned children, both groups showed a similar attenuation in values postburn (58% of nonburn values). Both boys and girls also showed a similar increase after exercise training (71% of nonburn values). These data suggest that burn injury does not have sex-dependent effects on strength and cardiorespiratory fitness.

Oxygen uptake and heart rate increase in a linear fashion with exercise intensity. We previously showed that, during submaximal exercise, cardiac output is lower in burned children than nonburned age- and sex-matched children [32]. Additionally, burned children display signs of exercise intolerance and have a lower peak heart rate [32,33]. Notably, others have found that burn injury causes cardiac failure, particularly left ventricular myocardial depression in burned children [34]. When normalized to kilograms of total lean mass, oxygen uptake at submaximal exercise intensities did not differ between burned and nonburned groups. However, expressing oxygen output as a percentage of peak VO_2 revealed that burned children exercised at a greater percentage of their capacity. At stage 1 of the modified Bruce test (1.7 mph at 0% grade, 1.7 metabolic equivalents), burned children exercised at 60% of peak VO_2 and nonburned children at only 30% peak VO_2. Similarly, at stage 4 (2.5 mph, 12% grade, 7 metabolic equivalents), burned children exercised at 97% of peak VO_2 and nonburned children at 70% peak VO_2. Exercise training partially restored relative oxygen uptake to nonburn values.

For submaximal heart rate, we found that burned children worked at a higher heart rates (absolute and percent of peak value) than nonburned children during the first 4 stages of the exercise test. Importantly, burned children had lower peak heart rate than nonburned children, and this did not change after exercise training (163 vs 192 bpm). Future work should understand the mechanisms underlying impaired cardiac function postburn, given that long-term cardiorespiratory impairments may be present [35]. Our results also highlight the need for burn-specific guidelines in rehabilitation exercise medicine, especially because heart rate- or oxygen uptake-based training (i.e., percent heart rate/oxygen uptake max) is used as a guide for exercise prescription.

An important limitation of our study is that current treatments to reduce or reverse the effects of severe burn injury in pediatric burn patients may include pharmacologic agents such as beta blockers (e.g., propranolol) and anabolic agents (e.g., oxandrolone). We did not match drug treatments between groups. We have previously reported that exercise in isolation or with oxandrolone increases LBM in children [36]. Likewise, propranolol improves lean mass, strength, and peak VO_2 in children [37]. Notably, as we have recently reported, administration of propranolol does not affect exercise heart rate response and therefore, burned children taking propranolol can appropriately maintain the prescribed intensity of exercise during training sessions when heart rate is used to guide exercise intensity during exercise rehabilitation [33]. However, whether propranolol affects cardiovascular responses to exercise differently based on sex is unknown. Lastly, hospitalization was significantly longer in girls than boys, and this may have affected girls' body composition.

In summary, sex does not affect LBM, strength, or cardiorespiratory fitness at discharge and after a RET program. However, sex may affect fat mass. Our results are in agreement with previous studies showing that early intervention consisting of resistive and aerobic exercise programs is essential for improving LBM, muscle strength, and peak cardiorespiratory fitness [17–21]. We show, for the first time, that submaximal oxygen uptake and heart rate expressed relative to peak values differ in burned and nonburned children, providing a rationale for burn-specific RET programs. Lastly, even though our training program improved these measures, a continued exercise regimen may be needed for long-term rehabilitation of severely burned pediatric patients.

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Highlights

- Sex differences in survival from burn injury exist; however, it is unknown if burns have sex-dependent effects on body composition, and exercise strength and aerobic capacity pre or post-rehabilitation training
- Lean body mass was similar at discharge and improved to a similar extent after rehabilitation.
- Boys with burn injury had different changes in fat mass than body from pre to post-rehabilitation compared to burned girls.
- Strength and aerobic exercise capacity was lower at discharge compared to nonburned children and increase the same in both sexes after rehabilitation.
- Both sexes work at greater relative submaximal exercise oxygen uptake and heart rates than nonburned children

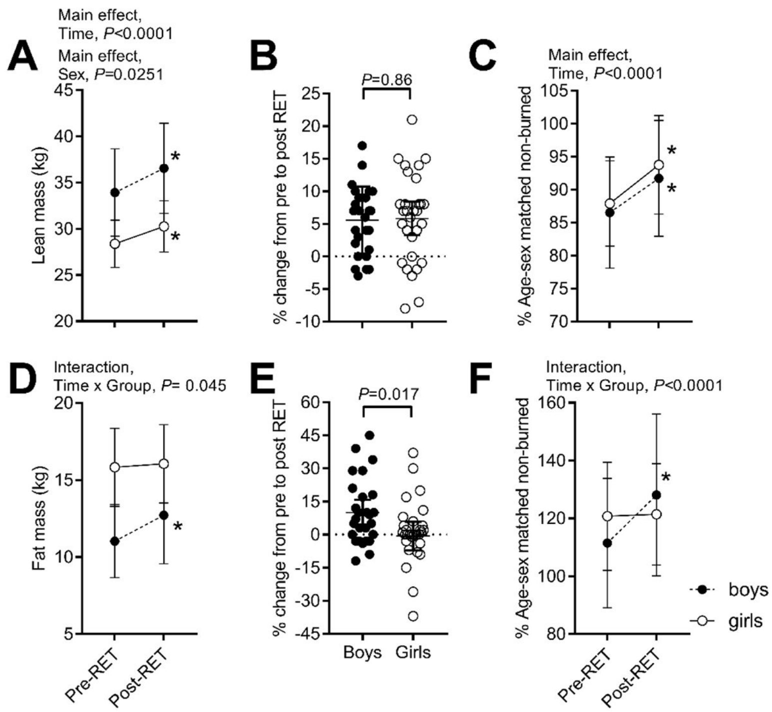

Figure 1.

Effect of rehabilitative exercise training (RET) on body composition in boys and girls. Lean mass (A–C) and fat mass (D–F), expressed as an absolute value (A,D), a relative change from pre- to post RET (B,E), or a percentage of age-and sex-matched nonburn values (C,F). *P<0.05 vs. pre-RET.

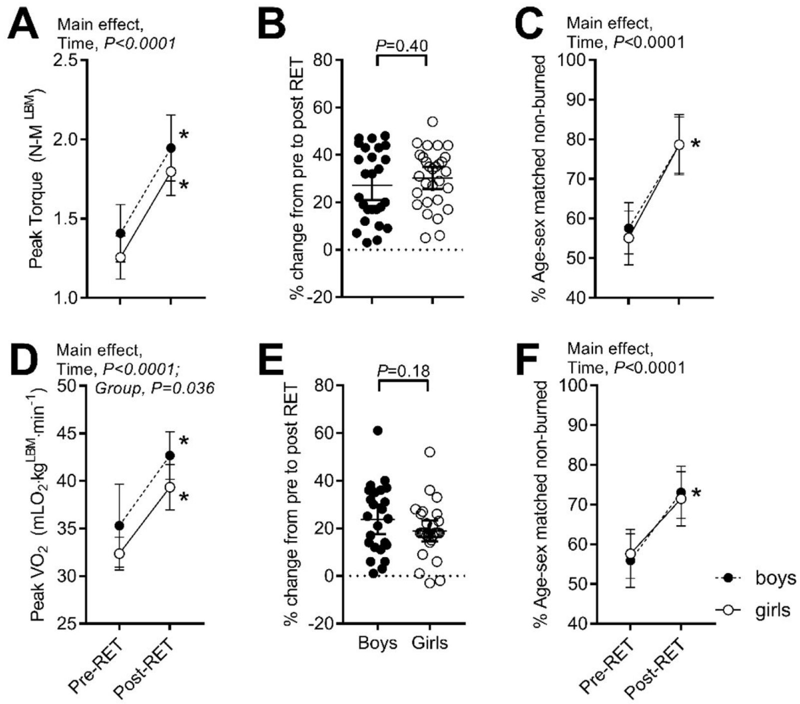

Figure 2.

Effect of rehabilitative exercise training (RET) on strength and cardiorespiratory fitness in boys and girls. Peak torque (A–B) and Peak VO_2 (D–F), normalized to lean body mass (LBM) (A,D), expressed as a relative change from pre- to post-RET (B,E), or expressed as a percentage of age- and sex-matched nonburn values (C,F). *P<0.05 vs. pre-RET.

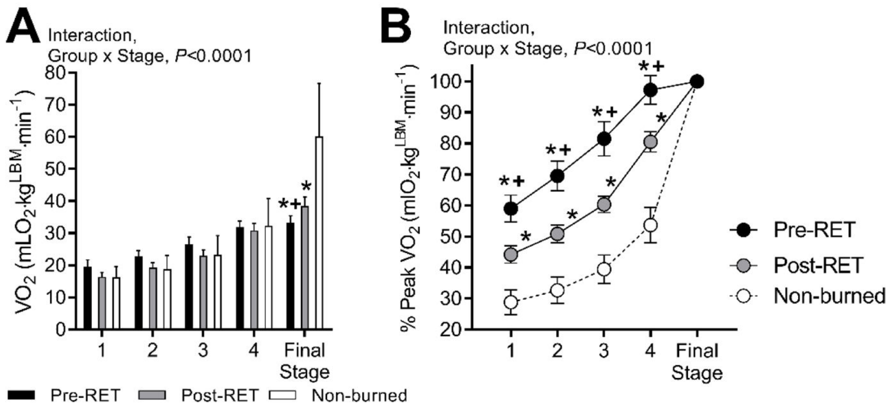

Figure 3.

VO_2 response to submaximal and maximal exercise in burned boys and girls. VO_2 is shown during the 4 stages (submaximal) and final stage (peak) of the modified Bruce protocol and is (A) normalized to lean body mass (LBM) or (B) expressed as a percentage of peak heart rate at discharge (pre-rehabilitative exercise training [RET]). Values for age- and sex-matched nonburned children are shown for comparison. $^*P<0.05$, burned vs. nonburned children. $^+P<0.05$, pre- vs. post-RET.

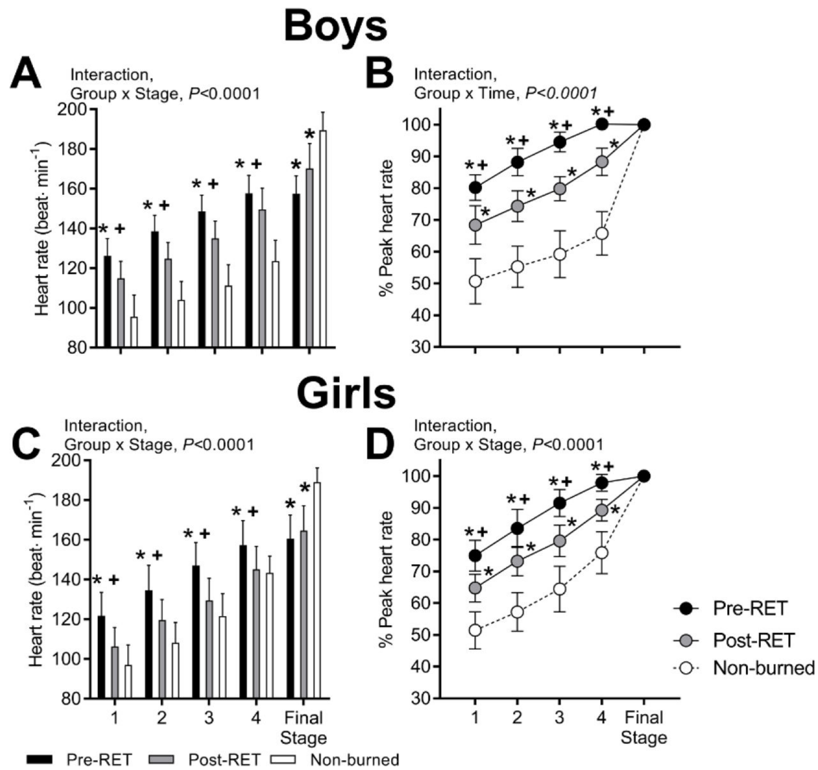

Figure 4.

Heart rate response to submaximal and maximal exercise in burned boys and girls. Heart rate is shown during the early 4 stages (submaximal) and final stage (peak) of the modified Bruce protocol and is reported as (A) an absolute value or (B) a percentage of peak heart rate at discharge (pre-rehabilitative exercise training [RET]). Values for age- and sex-matched nonburned children are shown for comparison. *P<0.05, burned vs. nonburned. $^{+}$P<0.05, pre- vs. post-RET.

Table 1

Subject characteristics

Characteristic†	Boys		Girls		*P* value
	Burned	**Nonburned**	**Burned**	**Nonburned**	
n	26	26	25	25	
Age (y)	12.9 [11.5,14.3]	12.7 [11.2,14.1]	12.7 [11.5,14.0]	12.8 [11.5,14.0]	0.99
Hospitalization (days)	29 [24,40]	-	43 [33,53]	-	**0.02**
Height (cm)	152.4 [143.6,161.2]	155.7 [147.3,164.0]	150.4 [144.3,156.6]	149.8 [145.2,154.3]	0.64
Weight (kg)	54.0 [44.9,63.1]	53.4 [45.3,61.5]	53.0 [45.4,60.6]	45.7 [40.7,50.6]	0.35
TBSA burn (%)	54 [49,59]	-	53 [47,59]	-	0.82
TBSA 3rd-degree burn (%)	37 [29,45]	-	40 [32,49]	-	0.59

†Data reported as mean [95% CI].

TBSA, total body surface area