Resistance Training Frequencies of 3 and 6 Times Per Week Produce Similar Muscular Adaptations in Resistance-Trained Men

Juraj Saric,[1] Domagoj Lisica,[1] Ivan Orlic,[1] Jozo Grgic,[2] James W. Krieger,[3] Sasa Vuk,[1] and Brad J. Schoenfeld[4]

[1]*Faculty of Kinesiology, University of Zagreb, Zagreb, Croatia;* [2]*Institute for Health and Sport (IHES), Victoria University, Melbourne, Australia;* [3]*Weightology, LLC, Redmond, Washington; and* [4]*Department of Health Sciences, Lehman College, Bronx, New York*

Abstract

Saric, J, Lisica, D, Orlic, I, Grgic, J, Krieger, JW, Vuk, S, and Schoenfeld, BJ. Resistance training frequencies of 3 and 6 times per week produce similar muscular adaptations in resistance-trained men. *J Strength Cond Res* XX(X): 000–000, 2018—We examined the effects of resistance training (RT) frequency performed 3 times per week (RT3) vs. RT performed 6 times per week (RT6) under volume-equated conditions in resistance-trained men. Twenty-seven men were randomly allocated to RT3 ($n = 14$) or RT6 ($n = 13$). The supervised training intervention lasted for 6 weeks. Upper- and lower-body strength were assessed using the 1 repetition maximum test. Also, muscular endurance (60% 1 repetition maximum performed to momentary failure) and muscle thickness (elbow flexors, elbow extensors, rectus femoris, and vastus intermedius) were measured before and after intervention. Pre-to-post intervention, both groups increased upper-body strength (RT3: +4%; RT6: +6%) and lower-body strength (RT3: +22%; RT6: +18%) with no significant between-group differences. No significant pre-to-post intervention increases in muscular endurance were seen in either of the training groups. Both groups increased elbow extensor thickness (RT3: +14%; RT6: +11%), rectus femoris thickness (RT3: +5%; RT6: +6%), and vastus intermedius thickness (RT3: +10%; RT6: +11%) with no significant between-group differences. Only the RT3 group significantly increased elbow flexor thickness from pre-to-post intervention (+7%). When training volume is equated, it seems that RT performed either 3 or 6 times per week can result in similar strength gains over a 6-week training period. Furthermore, under volume-equated conditions, comparable hypertrophy results may also be expected with both RT frequencies. Finally, no changes were seen in muscular endurance possibly because of the considerable interindividual variability in responses. The findings presented herein might be of interest to coaches, exercise practitioners, athletes, and recreational trainees.

Key Words skeletal muscle, ultrasound, growth, muscle size, strength

Address correspondence to Brad J. Schoenfeld, bradschoenfeldphd@gmail.com.

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Introduction

Participation in resistance training (RT) programs can bring about significant increases in muscle size and strength (2). Both of these muscular components are important for health, activities of daily living, and athletic performance (29,30). Muscle hypertrophy occurs as cumulative result of transient increases in muscle protein synthesis (MPS) above that of muscle protein breakdown (17). Muscle protein synthesis can be significantly stimulated by the ingestion of dietary protein as well as with RT (18). This RT-induced increase in MPS can overcome rates of muscle protein breakdown and thus promote a net protein accretion (17). In untrained individuals, the MPS increase after RT is elevated for ~48 hours (18), and likely contributes to the American College of Sports Medicine (2) recommendation for a training frequency of 2–3 times per week when the training goal is muscular hypertrophy. However, there is evidence that in resistance-trained individuals, this response is blunted whereby the postexercise MPS response lasts only for ~24 hours (7). Based on these findings and considering that only a few sets per training session are sufficient to increase MPS (5), some researchers have hypothesized that trained individuals may benefit from working a muscle group with a higher weekly training frequency and a lower per session volume (8). These researchers suggested that training a muscle group up to 6 times per week might be a beneficial strategy for increasing muscle mass in this population through the frequent elevations in MPS (8). Two recent studies explored this topic in trained individuals and compared training frequencies of 1 vs. 5 times per week, and 3 vs. 6 times per weeks (Ref. 9, Ref. 6 respectively). However, these studies assessed changes in lean body mass and did not use site-specific measures of muscular hypertrophy such as B-mode ultrasound, thus leaving a gap in the literature.

A recent meta-analysis suggested that a dose-response relationship exists between weekly RT frequency and gains in muscular strength (10). However, this analysis also showed that under volume-equated conditions, there was no significant effect of RT frequency on strength gains. Still, the authors noted the analysis was limited by the small number of studies (i.e., 3) conducted in trained individuals. Furthermore, almost all the studies examined training frequencies of 4 times per week or less; none of the included studies investigated very high training frequencies such as RT performed 6 times per week. Data presented at the 2012 European College of Sport Science conference showed that trained powerlifters increased muscular strength to a greater extent when training 6 times per week in comparison with the group training only 3 times per week (19). Interestingly, this effect was observed even under volume-equated conditions. However, the results of this study have not been published, and thus, the findings cannot be adequately scrutinized. In contrast to these preliminary findings, a recent study by Colquhoun et al. (6) compared training frequencies of 3 vs. 6 times per week and reported similar increases in strength in both groups. Given the current limited and contrasting findings, it is evident that further work exploring this topic is warranted.

For muscle hypertrophy, the current body of evidence indicates that training a muscle group 2 times per week may be more effective than training a muscle group once per week (26). However, the hypertrophy responses to very high weekly training frequencies remain unclear (26). Furthermore, for gains in strength, the current findings indicate that similar strength gains can be attained using vastly different training frequencies, provided that total volume is equated (10). That said, again, the responses to very high frequencies such as training 6 times per week are still underinvestigated (10).

Therefore, taking into account the evident lack of similar studies conducted in this area, the purpose of this study was to investigate the influence of volume-equated RT frequencies of 3 vs. 6 times per week in trained men on muscular strength, endurance, and hypertrophy. Based on the volume-equated study design (10,21,25), we hypothesized that there would be no significant differences between the training groups for any of the evaluated outcomes.

Methods

Experimental Approach to the Problem

Thirty resistance-trained men were randomly assigned to training 3 times per week (RT3; $n = 15$) or 6 times per week (RT6; $n = 15$) for 6 weeks. The RT3 group trained each muscle group 3 times per week, whereas the RT6 group trained each muscle group 6 times per week using a full-body routine. The training protocol included a mixture of single-joint and multi-joint exercises. The weekly set training volume was equated between the groups. All exercises were performed for 6–12 repetitions to muscular failure. Testing of muscular strength was performed using the 1 repetition maximum (1RM) for the barbell bench press exercise and barbell back squat exercise. Changes in muscle thickness (MT) of the elbow flexors, elbow extensors, rectus femoris, and vastus lateralis were measured using B-mode ultrasound.

Subjects

Based on an a priori power analysis using the G*Power software (Germany, Düsseldorf, version 3) with an expected effect size of 0.60 (for vastus lateralis MT as the outcome measure (27)), the alpha error level of 0.05, and the statistical power of 80%, the required sample size for this study was 20 participants. We recruited 30 resistance-trained men (mean ± *SD*; age = 22.6 ± 2.1 years [all subjects were over 18. The youngest subject in this study was 20 years of age], stature = 183.1 ± 6.0 cm, body mass = 87.2 ± 11.6 kg) for the study. The criterion for defining participants as resistance-trained was that they were training minimally 2 times per week for the past 6 months before the start of the study, using exercises for both upper- and lower-body musculature. This was set as an inclusion criterion for the current study. The participants were randomly assigned to training 3 times per week (RT3; $n = 15$) or 6 times per week (RT6; $n = 15$). An independent *t*-test showed no significant difference between the groups in age, body mass, or height at baseline. Three participants dropped out of the study (one participant due to personal reasons and 2 because of non–training-related injuries). Therefore, 14 and 13 participants from the RT3 and RT6 per week groups, respectively, were included in the final analysis. Training adherence was 100% in both groups, and no adverse effects occurred from the intervention. The experimental protocol, risks, and benefits were explained to the participants before the training protocol began, and all the participants gave a written informed consent. Ethical approval was granted by the Committee for Scientific Research and Ethics of the Faculty of Kinesiology at the University of Zagreb, Croatia.

Procedures

Training Protocol. The RT3 group trained each muscle group 3 times per week, whereas the RT6 group trained each muscle group 6 times per week using a full-body routine. The training protocol included a mixture of single-joint and multi-joint exercises. A summary of the RT programs can be found in Table 1. The weekly set training volume was equated between the groups. All exercises were performed for 6–12 repetitions to muscular failure. When necessary, loads were adjusted to maintain the prescribed number of repetitions. Concentric and eccentric actions were performed with a cadence of 1–2 seconds. Rest interval

Table 1. Resistance training protocols.*

Group	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
RT3	Cross cable fly × 4 Bent-over barbell row × 4 Lateral raises × 4 Overhead dumbbell extensions × 4 Machine biceps curl × 4 Leg press × 4 Lying leg curl × 4	Off	Dumbbell fly × 4 Seated cable row × 4 Face pulls × 4 Lying triceps press × 4 Dumbbell biceps curl × 4 Leg extension × 4 Stiff-leg deadlift × 4	Off	Pec-dec fly × 4 Lat-pulldown × 4 Dumbbell shoulder press × 4 Triceps extension × 4 Barbell biceps curl × 4 Squat × 4 Lying leg curl × 4	Off	Off
RT6	Cross cable fly × 2 Bent-over barbell row × 2	Dumbbell fly × 2 Seated cable row × 2	Pec-dec fly × 2 Lat-pulldown × 2	Cross cable fly × 2 Bent-over barbell row × 2	Dumbbell fly × 2 Seated cable row × 2	Pec-dec fly × 2 Lat-pulldown × 2	Off
	Lateral raises × 2 Overhead dumbbell extensions × 2	Face pulls × 2 Lying triceps press × 2	Dumbbell shoulder press × 2 Triceps extension × 2	Lateral raises × 2 Overhead dumbbell extensions × 2	Face pulls × 2 Lying triceps press × 2	Dumbbell shoulder press × 2 Triceps extension × 2	
	Machine biceps curl × 2	Dumbbell biceps curl × 2	Barbell biceps curl × 2	Machine biceps curl × 2	Dumbbell biceps curl × 2	Barbell biceps curl × 2	
	Leg press × 2 Lying leg curl × 2	Leg extension × 2 Stiff-leg deadlift × 2	Squat × 2 Lying leg curl × 2	Leg press × 2 Lying leg curl × 2	Leg extension × 2 Stiff-leg deadlift × 2	Squat × 2 Lying leg curl × 2	

*RT3 = resistance training 3 times per week; RT6 = resistance training 6 times per week.

duration between sets was 60–90 seconds and between exercises 2–3 minutes (11). The training intervention lasted for 6 weeks. Volume load was calculated as load × repetitions × sets and was analyzed per muscle group (i.e., chest, back, shoulders, elbow extensors, elbow flexors, anterior thigh, and posterior thigh). All training sessions were supervised by personal trainers.

Strength Assessment. Testing of muscular strength was performed 48 hours after an RT session using the 1RM test, defined as the maximum load lifted with a proper form through a full range of motion. Upper-body strength was assessed first, using the barbell bench press exercise; lower-body strength was assessed second, using the barbell back squat exercise. A detailed explanation of the protocols can be found elsewhere (27). Briefly, after a 5–10-minute warm-up, the participants performed 3 sets, progressively increasing the load from 50%, 60–80%, to 90% of their estimated 1RM while performing 5, 2–3, and 1 repetition, respectively. Then, the participants performed the 1RM test. The load for the subsequent attempts was increased or decreased based on whether the participant lifted the load or not. All assessments were performed within 5 attempts, using a 3–5-minute rest interval between attempts. After the final 1RM attempt, the participants rested for 5 minutes, after which muscular endurance was assessed. The muscular endurance test consisted of one "all-out" set with a load of 60% 1RM performed to muscular failure on the above-mentioned upper- and lower-body exercises. A cadence of 1–2 seconds was used both for the concentric and eccentric portions of the lift. When the participants were unable to do the whole range of motion of the exercise or maintain the prescribed cadence, the test was terminated.

Muscle Thickness. Before and after the RT intervention MT of the elbow flexors, elbow extensors, rectus femoris, and vastus lateralis were measured by a skilled technician using B-mode ultrasound (Sonoscape S40; Sonoscape Co. Ltd., Beijing, China). The MT assessment was performed 48 hours after the last training session. To prevent confounding factors for the assessment of MT, the measurement sessions were performed at the same time of day for each participant. Participants were instructed to maintain their usual level of hydration, and the measurements were performed a minimum of 2 days after an RT session to prevent any swelling effects. A detailed explanation of the protocol can be found elsewhere (1). In brief, a water-soluble transmission gel was applied to the muscle being assessed. Thereafter, a 5–13-MHz ultrasound probe was placed perpendicular to the tissue interface. Caution was taken not to depress the skin. When the quality of the image was satisfactory, it was saved on a hard drive. Two images were taken and the average values were used for the analysis. The MT dimensions were measured as described by Abe et al. (1). For the elbow flexors and extensors, the measurements were taken 60% distal from acromion to lateral epicondyle of the humerus. The vastus lateralis and rectus femoris measures were taken at a distance of 50% between the lateral epicondyle of the femur and the greater trochanter. The coefficients of variations for repeated measures for the elbow flexors, elbow extensors, rectus femoris, and vastus lateralis MT were 2.4%, 3.2%, 2.5%, and 2.1%, respectively. Ultrasound imaging has been used in similar previous research and is highly correlated with magnetic resonance imaging (3).

Statistical Analyses

Data were modeled using both a frequentist and Bayesian approach. The frequentist approach involved 2×2 linear mixed models with repeated measures, estimated by a restricted maximum likelihood algorithm, and the Bayesian approach involves JZS Bayes factor repeated-measures analysis of variance with default prior scales (22). Training frequency (RT3 or RT6) was included as the between-subject factor, time (pre and post) was included as the repeated within-subjects factor, and group $\times$ time was included as the interaction. The subject was included as a random effect in the linear mixed models, and repeated covariance structures were specified as compound symmetry. When significant interactions were identified in the linear mixed models, post hoc comparisons between groups over time were compared using F-tests with a Bonferroni correction. Effect sizes were calculated as the mean pre-post change divided by the pooled pretest *SD* (14). In addition, percent changes were calculated. Total volume load between the groups was compared using an independent *t*-test. Baseline differences in the dependent variables between the groups were compared using an independent *t*-test. No significant baseline differences were observed for the dependent variables ($p > 0.05$ for all dependent variables). Analyses were performed using NCSS Version 12 (Kaysville, UT, USA) and JASP 0.8.5 (Amsterdam, the Netherlands). Effects were considered significant at $p \leq 0.05$. Bayes factors for effects were interpreted as "weak," "positive," "strong," or "very strong" according to Raftery (20). Data are reported as $\pm SD$ unless otherwise specified.

Results

Volume Load

There were no differences in volume load between the RT3 and RT6 groups for chest (RT3 = 25,264 ± 6,866; RT6 = 29,585 ± 6,884; $p = 0.155$), back (RT3 = 53,872 ± 13,343; RT6 = 58,703 ± 8,357; $p = 0.268$), shoulders (RT3 = 20,122 ± 5,067; RT6 = 22,815 ± 4,401; $p = 0.152$), elbow extensors (RT3 = 23,609 ± 6,261; RT6 = 26,846 ± 3,640; $p = 0.112$), elbow flexors (RT3 = 20,706 ± 4,840; RT6 = 23,946 ± 4,561; $p = 0.085$), and anterior thigh (RT3 = 107,404 ± 23,659; RT6 = 121,660 ± 31,664; $p = 0.201$). A significant difference in volume load was seen for the posterior thigh favoring RT6 (RT3 = 55,286 ± 15,675; RT6 = 66,285 ± 9,741; $p = 0.038$).

Muscle Size

There was a significant interaction for elbow flexor MT ($p < 0.001$). Elbow flexor MT significantly increased in the RT3 group ($p = 0.005$), but not in the RT6 group ($p = 1.0$). There was positive evidence ($3 \leq BF_{10} \leq 20$) in favor of the interaction compared with the null model, and positive evidence ($BF_{10} = 4.6$) in favor of the interaction over main effects.

There was a significant improvement ($p < 0.001$) from pre to post in elbow extensor MT, with no significant group by time interaction. There was very strong evidence ($BF_{10} > 150$) in favor of a time effect for elbow extensor MT compared with the null model, and positive evidence ($BF_{10} = 3.9$) in favor of a main time effect over an interaction.

There was a significant improvement ($p = 0.008$) from pre to post in rectus femoris MT, with no significant group by time interaction. There was positive evidence ($3 \leq BF_{10} \leq 20$) in favor of a time effect for rectus femoris MT compared with the null model, and positive evidence ($BF_{10} = 3.7$) in favor of a main time effect over an interaction.

There was a significant improvement ($p < 0.001$) from pre to post in vastus lateralis MT, with no significant group by time interaction. There was strong evidence ($20 \leq BF_{10} \leq 150$) in favor of a time effect for vastus lateralis MT compared with the null model, and positive evidence ($BF_{10} = 5.2$) in favor of a main time effect over an interaction.

Strength and Endurance

There was a significant improvement ($p < 0.001$) from pre to post in squat 1RM, with no significant group by time interaction. There was very strong evidence ($BF_{10} > 150$) in favor of a time effect for squat 1RM compared with the null model, and positive evidence ($BF_{10} = 3.2$) in favor of a main time effect over an interaction (Table 2). There was a significant improvement ($p < 0.001$) from pre to post in bench 1RM, with no significant group by time interaction. There was very strong evidence ($BF_{10} > 150$) in favor of a time effect for bench 1RM compared with the null model, and weak evidence ($BF_{10} = 1.9$) in favor of a main time effect over an interaction.

There were no significant main effects or interactions for lower-body muscular endurance. Evidence favored the null hypothesis ($BF_{10} < 1$) of no group or time effects. There were no significant main effects or interactions for upper-body muscular endurance. Evidence favored the null hypothesis ($BF_{10} < 1$) of no group or time effects.

Discussion

This study aimed to investigate the effects of RT frequency performed 3 vs. 6 times per week on muscular adaptations in trained men. Our hypothesis was that there would be no significant differences between the training

Table 2. Summary of study results.*

Outcome	Group	Pre mean ± *SD*	Post mean ± *SD*	*p* (Group)	*p* (Time)	*p* (group × time)	BF_{10} (group)	BF_{10} (time)	BF_{10} (group + time)	BF_{10} (group + time + group × time)	ES	Percent changes (%)
Squat 1RM (kg)	3	122.9 ± 29.6	149.8 ± 22.7	0.72	<0.001†	0.35	0.44	3.79×10^{8}‡	2.30×10^{8}	1.18×10^{8}	1.01	+22
	6	128.5 ± 24.1	151.2 ± 25.3								0.85	+18
Bench 1RM (kg)	3	91.3 ± 19.4	94.5 ± 19.5	0.35	<0.001†	0.14	0.71	260.39‡	168.45	136.17	0.17	+4
	6	96.7 ± 18.4	102.9 ± 19.2								0.33	+6
Squat with 60% 1RM (repetitions)	3	35.5 ± 15.1	41.4 ± 11.1	0.21	0.16	0.17	0.76	0.67	0.50	0.36	0.49	+17
	6	33.5 ± 8.0	33.5 ± 8.7								0.01	0
Bench press with 60% 1RM (repetitions)	3	23.7 ± 3.0	24.9 ± 4.6	0.34	0.63	0.34	0.51	0.70	0.16	0.09	0.44	+5
	6	23.4 ± 2.1	23.0 ± 3.8								−0.15	−2
Elbow flexor thickness (mm)	3	38.2 ± 3.8	40.9 ± 4.3	0.28	0.05	<0.001†	0.67	1.17	0.81	3.70‡	0.66	+7
	6	41.3 ± 3.9	40.9 ± 3.3								−0.09	−1
Elbow extensor thickness (mm)	3	39.5 ± 7.4	45.1 ± 4.9	0.31	<0.001†	0.62	0.57	18,580.99‡	12,531.92	4,814.80	0.83	+14
	6	42.1 ± 6.1	46.9 ± 5.0								0.71	+11
Rectus femoris thickness (mm)	3	25.6 ± 4.7	26.8 ± 4.6	0.28	0.008†	0.76	0.72	6.98‡	4.91	1.89	0.30	+5
	6	23.9 ± 2.6	25.3 ± 2.7								0.37	+6
Vastus intermedius thickness (mm)	3	21.0 ± 4.1	23.1 ± 3.1	0.61	<0.001†	0.89	0.49	82.72‡	44.46	15.91	0.57	+10
	6	21.6 ± 3.5	23.9 ± 3.8								0.61	+11

*1RM = 1 repetition maximum; ES = effect size.
†Significant at $p < 0.05$.
‡Preferred model based on highest $BF_{10} \geq 1$.

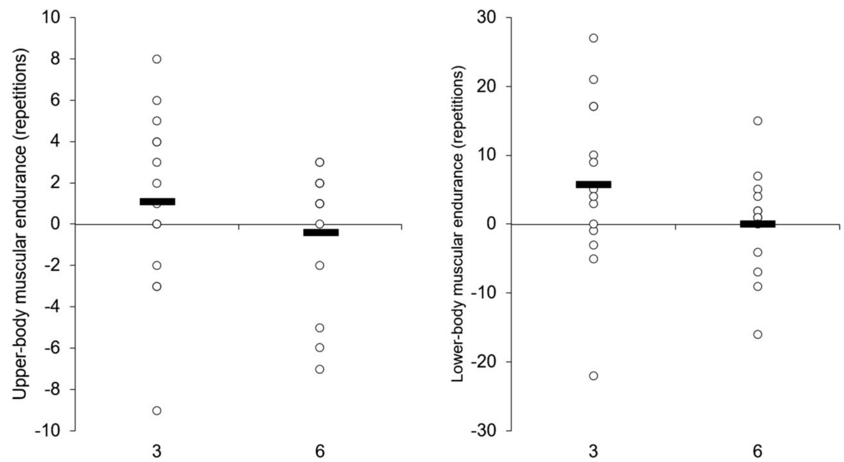

Figure 1. Individual responses in upper- and lower-body muscular endurance from the groups training 3 and 6 times per week.

groups for any of the evaluated outcomes. Herein, we show that both training frequencies were equally effective for increasing muscular strength. For muscle size, training a muscle group either 3 or 6 times per week resulted in similar gains for most, but not all, of the measured sites. Finally, neither of the training groups increased muscular endurance from pre-to-post training intervention. Taken together, these results only partially confirmed our initial hypothesis.

This study is the first that compared training frequencies of 3 and 6 times per week in trained men while using site-specific measures of muscular growth. In most of the measured sites, both groups showed significant pre-to-post training intervention increases in MT with no between-group differences. This would suggest that gains in muscle mass were similar between the groups, despite speculation that the group training 6 times per week stimulated MPS more often than the group training 3 times per week. These results contradict the hypothesis put forth by Dankel et al. (8). As acknowledged by those authors, their assumption was solely based on the MPS response after RT, which may not reflect long-term hypertrophy adaptations to regimented RT. It is interesting to note that only the RT3 group experienced significant pre-to-post increases in MT of the elbow flexors. Although unexpected, these findings might be explained by the specificity of the training protocol. As compared to the elbow extensors, training for the elbow flexors included more indirect activation through exercises that were used to target the back musculature, whereas the elbow extensors were mostly trained through single-joint, isolation exercises. Therefore, it is plausible that the elbow flexors experienced more per session fatigue in the RT6 group, and thus were not completely recovered before the next training session. Taken together, it might be that this constant fatigue in the elbow flexors blunted significant growth in the RT6 group; although, given that we did not assess fatigue directly in this study, this idea remains speculative.

Upper- and lower-body strength increased from pre-to-post intervention in both groups, with no significant between-group differences. A comparison of the present results with the findings from the literature is difficult, considering the paucity of similar studies. To the best of our knowledge, only one previously published study used a comparable study design. Colquhoun et al. (6) included 28 trained men in their trial, in which one group trained 3 times per week ($n = 16$), whereas the other group trained 6 times per week ($n = 12$). After a 6-week intervention, both training groups increased upper- and lower-body muscular strength with no significant between-group differences. Our results lend support to these findings, indicating that strength gains are very similar between these training frequencies. Other studies in trained men that compared training frequencies of (a) 1 vs. 2 times per week, (b) 1 vs. 3 times per week, and (c) 2 vs. 4 times per week also showed statistically similar increases in strength regardless of training frequency (4,28,31). Furthermore, a recent study by Gomes et al. (9) compared training frequencies of 1 vs. 5 times per week and also reported no significant differences in strength gains between the groups. In summary, coupled with the meta-analytic findings (10), it seems that under volume-equated conditions, training frequency does not play a large role in strength gain as other training variables such as load (24). It is possible that training frequency would have a more substantial impact over longer time courses, as the Norwegian Frequency Project lasted 16-weeks; however, this remains speculative and future research is warranted. Furthermore, it should be made clear that our program had more of a hypertrophy focus, whereas the Norwegian Frequency Project was more directed toward improvements in strength, given their sample (i.e., powerlifters).

To explore the importance of training specificity for gains in strength, we used testing of strength both in an exercise that was used in the training program (i.e., squat) and an exercise that was not included in the RT program (i.e., bench press). Although the participants increased both upper- and lower-body strength, the effect sizes and percent changes were larger for lower-body strength gains (as compared to the upper-body changes). These results do highlight that RT may result with strength gains even when tested in an "unaccustomed" exercise; however, these gains are mostly specific to the movement that is trained (23).

The exercise protocol used in this study was not sufficient to elicit significant increases in muscular endurance in either of the training groups. These results are somewhat surprising, considering that improvements in muscular endurance with regimented RT in trained individuals have been noted by others (27). It is relevant to highlight that the RT3 group did show moderate effect sizes both for upper-body (effect size = 0.44; +5%) and lower-body (effect size = 0.49; +17%) muscular endurance. No effects were observed in the RT6 group for upper and lower-body muscular endurance. It might be that significance was not observed in this test due to the large variability in responses among the participants in both groups (Figure 1).

Although this study had several strengths, including the use of a direct measure of muscle growth, full RT supervision, and 100% adherence to the training sessions, there are several limitations that warrant consideration. First, the training protocol was somewhat short because it lasted only 6 weeks. It is conceivable that results would have differed with a longer-duration training intervention. Second, we did not control for nutritional status. The importance of dietary protein for muscular growth is well established (15) and this may have confounded results. That said, randomization should theoretically have reduced the effects of any between-group differences in nutrient consumption. Third, our results are specific to young, resistance-trained men. Men and women have different physiological characteristics such as different muscle fiber distribution, differences in muscle perfusion, and marked differences in fatigability (12). Women seem to experience faster recovery of muscular strength as compared to men (13) and, therefore, might respond better to higher training frequencies (10). Similar study designs are warranted in women to examine whether there is a sex-specific response to RT frequency. Furthermore, our results are specific to young individuals. Therefore, they cannot be generalizable to older adults, given that recovery from RT is altered in this age group (16), which may warrant different RT frequency prescription. Finally, we did not consider the RT frequencies usually used by the participants before their enrollment into the study. Therefore, for some, RT frequencies used in the present training program might have provided a novel stimulus and for others, they might have been comparable with their usual training practices. Future studies performed in trained individuals should circumvent this limitation by asking the participants to indicate their usual RT frequency per muscle group before starting the training program.

In conclusion, this study indicates that under volume-equated conditions, there are no additional strength benefits to training muscle groups 6 days per week in resistance-trained men, and that very high training frequencies may, in some cases, hinder muscle hypertrophy.

Practical Applications

Both RT frequencies of 3 and 6 times per week can be effective for increases in muscular strength in trained men. Although training 6 times per week can result in significant hypertrophy, it seems that training 3 times per week under volume-equated conditions can, in some cases, be even more effective.

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