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Comparison of High-Intensity vs. High-Volume Resistance Training on the BDNF Response to Exercise

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1   **Comparison of High Intensity versus High Volume Resistance Training on the BDNF**

2   **Response to Exercise**

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22 **Abstract**

23 This study compared the acute and chronic response of circulating plasma brain-derived

24 neurotrophic factor (BDNF) to high-intensity low-volume (HI) and low-intensity high volume

25 (HV) resistance training. Twenty experienced resistance trained men (23.5±2.6 y, 1.79±0.05 m,

26 75.7±13.8 kg) volunteered for this study. Prior to the resistance training program (PRE),

27 participants performed an acute bout of exercise using either the HI (3-5 reps; 90% of one

28 repetition maximum [1RM]) or HV (10-12 reps; 70% 1RM) training paradigm. The acute

29 exercise protocol was repeated following 7-weeks of training (POST). Blood samples were

30 obtained at rest (BL), immediately- (IP), 30-min (30P) and 60-min (60P) post exercise at PRE

31 and POST. A 3-way repeated measure ANOVA was used to analyze acute changes in BDNF

32 concentrations during HI and HV resistance exercise, and the effect of 7-weeks of training. No

33 training x time x group interaction in BDNF was noted (p=0.994). Significant main effects for

34 training (p=0.050) and time (p<0.001) in BDNF were observed. Significant elevations in BDNF

35 concentrations were seen from BL at IP (p=0.001), 30P (p<0.001), and 60P (p<0.001) in both HI

36 and HV combined during PRE and POST. BDNF concentrations were also observed to increase

37 from PRE to POST when collapsed across groups and time. No significant group x training

38 interaction (p=0.342), training (p=0.105), or group (p=0.238) effect were noted in the BDNF

39 area under the curve response. Results indicate that BDNF concentrations are increased after an

40 acute bout of resistance exercise, regardless of training paradigm, and are further increased

41 during a 7-week training program in experienced lifters.

42 **Key Words:** Neurotrophin, resistance exercise, muscle, training status

43

44   **New and Noteworthy**

45   There have been a number of investigations examining the BDNF response to exercise, however

46   our understanding of changes in the BDNF response to resistance training has been primarily

47   limited to frail, older adults. This is the first study that has compared two different resistance

48   training paradigms in experienced, resistance trained adults and have demonstrated that training,

49   independent of resistance training paradigm, can modify the BDNF response to an acute bout of

50   resistance exercise.

51

Introduction

Brain-derived neurotrophic factor (BDNF) is a neurotrophin of the nerve-growth factor protein family, whose downstream effects are mediated through tropomyosin-related kinase (Trk) receptors (38). BDNF is present throughout the nervous system, and a crucial mediator in the formation of neuronal circuits throughout the brain where it promotes neuronal survival, neurite outgrowth, and synaptogenesis (12). BDNF associated adaptations to hippocampal architecture have been associated with positive changes in memory and learning (11, 30, 31, 41) and has been reported to ameliorate the response to stressful stimuli (20, 22). Despite its notable role in the central nervous system, expression of BDNF and its high affinity receptor TrkB are broad, being found in skeletal muscle, cardiac, liver, and adipose cells (26). While its role in the skeletal muscle is less clear, increased expression of skeletal muscle BDNF has been shown to increase fat oxidation in an AMP-activated protein kinase-dependent mechanism (28). However, BDNF synthesized in the skeletal muscle does not appear to contribute to systemic circulating levels, but rather acts in a paracrine or autocrine fashion (28). Preliminary data indicates that the brain is the primary source, providing approximately 80%, of circulating plasma BDNF in response to exercise (34).

Elevations in circulating BDNF concentrations have been demonstrated following an acute bout of both aerobic and resistance exercise (13, 27, 35, 43). A 4-fold increase in resting BDNF secretion rates (58 ng·100g^{-1}·min^{-1} to 206 ng·100g^{-1}·min^{-1}) were reported following three months of endurance training at ~65% of VO_{2max} (37). In addition, increases in circulating BDNF concentrations observed during exercise and in the recovery period appear to be associated with both duration and intensity of exercise (4, 13, 27, 35, 37). Ferris and colleagues (13) demonstrated that 30 minutes of cycling at 10% above subjects' ventilatory threshold

75 resulted in higher concentrations of BDNF than when cycling at 20% below. However, the total

76 amount of work performed was greater during the higher intensity protocol. In addition, Cho and

77 colleagues (4) reported greater elevations in circulating BDNF concentrations during a maximal

78 aerobic capacity test with greater duration of exercise. These data suggest that the greater

79 volume, or the combination of greater volume and/or higher intensity, may have provided the

80 stimulus for a greater BDNF response to exercise.

81   The vast majority of research investigating the BDNF response to physical activity has

82 primarily examined endurance exercise. The BDNF response during resistance exercise has not

83 been studied to the same extent. In a limited number of investigations, some investigators have

84 reported no change in the acute BDNF response to resistance exercise (18, 35), while others have

85 suggested that training can augment the BDNF response to resistance exercise in previously

86 untrained college-aged men (43). Most of the studies examining the BDNF response to resistance

87 training have been performed in older and frail adults. These studies have generally reported that

88 limited resistance training (3 times per week for 10 - 12 weeks) may be sufficient to increase

89 BDNF concentrations in older adults (5, 15, 31). The majority of these studies have examined

90 serum BDNF, which includes platelets that store and release BDNF in response to exercise. In

91 consideration that plasma is free of platelets, and BDNF turnover in the plasma is approximately

92 6 minutes (33), changes in plasma BDNF would be more indicative of an acute response to a

93 training stress. Furthermore, ~60-80% of plasma BDNF is thought to be produced in the brain

94 (34). To the best of our knowledge no studies have been performed on the plasma BDNF

95 response to resistance training in experienced, resistance trained men. Thus, the primary purpose

96 of this investigation was to compare the acute BDNF response to two common resistance

97 training paradigms before and following 7-weeks of training in experienced, resistance trained

98   adults. We hypothesize that resistance exercise will increase BDNF concentrations to both

99   training protocols. In addition, we further hypothesize that 7-weeks of training will augment the

100 BDNF response to exercise.

101 **Methods**

102 *Experimental Design*

103 Prior to the onset of the study, all participants were required to complete a 2-week preparatory

104 base resistance training program. Subsequently, participants were then randomly assigned to one

105 of two training groups: a high intensity, low-volume training group (HI; n = 10; 22.6 ± 2.3 years;

106 87.0 ± 15.1 kg; 1.80 ± 0.05 m; 15.9 ± 7.2% body fat) or a high-volume, moderate intensity

107 training group (HV; n = 10; 24.5 ± 2.6 years; 89.5 ± 12.9 kg; 1.66 ± 0.34 m; 20.6 ± 6.0% body

108 fat). All groups completed an 8-week resistance training program using a 4-day split routine.

109 Blood samples were collected during the first training session of week 1 (PRE) and week 8

110 (POST). These visits constituted the acute training protocols, during which, participants

111 performed the HI (3-5 reps; 90% of one repetition maximum [1RM]) or HV (10-12reps; 70%

112 1RM) training paradigm.

113 *Participants*

114   Twenty physically active, resistance-trained men agreed to participate in this study.

115 Following an explanation of all procedures, risks, and benefits, each participant provided his

116 informed consent to participate in the study. This investigation was approved by the New

117 England Institutional Review Board, and all procedures were in accordance with the ethical

118 standards of the 1964 Helsinki Declaration and its later amendments. All participants were free

119 of any physical limitations (determined by medical history questionnaire and PAR-Q) and had

120   been regularly participating (at the time of recruitment) in resistance training for a minimum of 2

121   years (5.7 ± 2.2 years).

122   Prior to the present investigation, all participants described their training habits to be

123   different from the present training regimen in terms of exercise order and groupings.

124   Approximately 82% of the participants described their normal repetition range to be either lower

125   (VOL = 77%) or higher (INT = 87%) than what they were assigned to in the study, with about

126   43% typically using a 6–10 RM range and another 21% using an alternating (or pyramid)

127   structure for specific multiple joint structural and assistance exercises. Additionally, 50% of the

128   participants reported using either longer (VOL = 54%) or shorter (INT = 47%) rest periods,

129   while approximately 29% did not track their rest times previously. The remaining participants

130   employed a similar training scheme (i.e., intensity, volume, and rest) to what they were assigned

131   to in the study.

132   *Preparatory Phase of Training*

133   All participants completed a preparatory resistance training protocol during the 2 weeks

134   prior to the training intervention (see Table 1). This phase encompassed a total of six workouts:

135   four workouts (Monday, Tuesday, Thursday, and Friday) during the first week and two workouts

136   (Monday and Tuesday) during the second week. The purpose of the preparatory training program

137   was to instruct proper lifting technique, familiarize participants with all exercises, and ensure the

138   participants initiated the study with a comparable training base. In comparison to the training

139   intervention groups, the exercises (and their order) were identical but the volume (6–8 RM) and

140   rest intervals (1–2 min) differed. Participants were instructed not to participate in any other form

141   of physical activity throughout the duration of the study.

142 *Anthropometric Assessments*

143   Anthropometric measurements for all participants were conducted approximately 24 h

144 prior to all strength measures. Height (±0.1 cm) and body mass (±0.1 kg) were determined using

145 a Health-o-Meter Professional scale (Model 500 KL, Pelstar, Alsip, IL) with the participants

146 standing barefoot, with feet together, and in their normal daily attire. Body fat percentage was

147 determined using whole body-dual energy x-ray absorptiometry (DXA) scans (Prodigy TM;

148 Lunar Corporation, Madison, WI). All measurements were performed by the same certified

149 radiological technician using standardized subject positioning procedures.

150 *Strength Testing*

151   To determine appropriate training load for both HI and HV, strength in the bench press

152 and squat exercises was assessed. Participants were scheduled for testing at a standard time of

153 day. A general warm up consisting of riding a cycle ergometer for 5 min at a self-selected

154 resistance preceded strength testing. Standardized procedures, as previously described (19) were

155 used for the 1RM barbell bench press and barbell back squat, respectively. Subjects performed

156 two warm-up sets at 40-60% and 60-80% of his perceived 1RM, respectively, before performing

157 3-4 subsequent trials to determine the 1RM. A 3-5 minute rest period was provided between each

158 trial. For all other exercises, the 1RM was assessed using a prediction formula based on the

159 number of repetitions performed to volitional fatigue using a given weight (3). Trials not meeting

160 the range of motion criteria for each exercise or using improper technique were discarded.

161 *Resistance Training Intervention*

162   Participants reported to the Human Performance Lab (HPL) four times per week, at the

163 same time of day, to complete their assigned training program (see Table 1). Both groups

164 performed the same exercise routine but differed in the intensity of exercise, number of

165 repetitions performed and rest interval between sets. Specifically, the HI training program

166 required participants to perform four sets of 3–5 repetitions with 90% of their 1RM, with 3-min

167 rest period between sets, while the HV group performed four sets of 10–12 repetitions with 70%

168 of their 1RM, with a 1-min rest period between sets. During the resistance training program the

169 load was increased for participants (regardless of group) when the required number of repetitions

170 (for a particular exercise) were achieved on two consecutive workouts. On average three to four

171 participants were being trained by study personnel at one time during the course of the resistance

172 training program. All study personnel were certified strength and conditioning specialists.

173   ***Insert Table 1 Here***

174 *Blood Sampling*

175   Blood samples were obtained at four time points: baseline (BL), immediately post-

176 exercise (IP), 30 minutes post-exercise (30P), and 60 minutes post-exercise (60P). Participants

177 reported to the Human Performance Lab (HPL) 3 hours post-prandial, at a standardized time of

178 day consistent with their normal training schedule. All blood samples at POST were taken at the

179 same time of day as PRE to avoid the confounding influence of diurnal variations. All blood

180 samples were obtained using a Teflon cannula placed in a superficial forearm vein using a three-

181 way stopcock with a male luer lock adapter and plastic syringe. The cannula was maintained

182 patent using an isotonic saline solution (Becton Dickinson, Franklin Lakes, NJ, USA). Blood

183 samples at BL were obtained following a 15-minute equilibration period. Participants were

184 instructed to lie in a supine position for 15 min prior to the 30P and 60P blood draws.

185   All blood samples were collected into a Vacutainer® tube containing no containing

186   K_2EDTA. The Vacutainer® tube was kept cold throughout processing in an attempt to reduce the

187   variations in BDNF concentrations during processing. A small aliquot of whole blood from the

188   tube was removed and used for determination of hematocrit and hemoglobin concentrations. The

189   blood was centrifuged at 3,000×g for 15 minutes. The resulting plasma was placed into micro-

190   centrifuge tubes and frozen at −80°C for later analysis.

191   *Blood Analyses*

192   Hematocrit concentrations were analyzed from whole blood via microcentrifugation

193   (CritSpin, Westwood, MA, USA) and microcapillary techniques. Hemoglobin concentrations

194   were analyzed from whole blood using an automated analyzer (HemoCue, Cypress, CA, USA).

195   Coefficient of variation for each assay was 1.53% for hematocrit and 0.55% for hemoglobin.

196   Plasma volume shifts were calculated using the formula established by Dill & Costill (9).

197   Multiplex ELISA was used to quantitate plasma BDNF concentrations using MAGPIX®

198   (Luminex, Austin, TX, USA) and a commercially available kit (EMD Millipore, Billerica, MA,

199   USA) according to manufacturer's guidelines. To eliminate inter-assay variance, all samples

200   were analyzed in duplicate by a single technician. The coefficient of variation for BDNF was

201   7.84%.

202   *Nutrient Intake and Dietary Analysis*

203   Participants were instructed to maintain their normal kilocaloric intake habits throughout

204   the investigation. Kilocaloric and macronutrient intake were monitored via weekly food diaries.

205   Consequently, all participants were required to record all food and beverage intake over the

206   course of 3 days (two weekdays and one weekend day) during the initial and final week of

207   (weeks 1 and 8) of the training program. The FoodWorks Dietary Analysis software version 13

208   (The Nutrition Company, Long Valley, NJ) was used to analyze dietary recalls.

209

210   *Statistical Analysis*

211   Prior to hypothesis testing, the Shapiro-Wilk test was used to evaluate the assumption of

212   normality for dependent variables. As our data was not normally distributed we opted to log-

213   transform BDNF measurements (using the natural logarithm). To examine group and training

214   differences in the BDNF response to exercise before and following the 7-week training program,

215   a three-way [training (PRE, POST) x time (BL, IP, 30P, 60P) x group (HI, HV)] repeated

216   measures analysis of variance (ANOVA) was performed. The effect of training on AUC

217   measures, calculated using the trapezoidal methods, was examined using a two-way [training

218   (PRE, POST) x group (HI, HV)] repeated measures ANOVA. In the event of a significant

219   interaction or main effect, Bonferroni post-hoc tests were performed. Interpretations of effect

220   size were evaluated (6) at the following levels: small effect (0.01-0.058), medium effect (0.059-

221   0.137), and large effect (>0.138). For all analyses a criterion alpha level of $p \leq 0.05$ was used to

222   determine statistical significance, and statistical software (SPSS V.21.0, Chicago, IL) was used.

223   All data are reported as mean ± SD.

224   **Results**

225   The effect of these different training paradigms on strength and anthropometric changes

226   have been reported elsewhere (25). For the purposes of this study, no differences were noted at

227   PRE between the groups in the 1RM squat (p=0.694), 1RM bench press (p=0.934) body mass

228   (p=0.715), lean body mass (p=0.611), or percent body fat (p=0.136). Relative energy intake did

229   not change significantly over the course of the investigation for HI (PRE: 38.2 ± 11.1 kCal·kg^{-1};

230   POST: 31.1 ± 5.3 kCal·kg^{-1}) or HV (PRE: 31.7 ± 7.0 kCal·kg^{-1}; POST: 29.2 ± 8.1 kCal·kg^{-1}).

231   Changes in plasma BDNF concentrations during PRE and POST are depicted in Fig 1.

232   No training x time x group interaction for plasma BDNF concentration was noted (F=0.026,

233   p=0.994, η^2=0.002). However, significant main effects for training (F=4.434, p=0.050, η^2=0.207)

234   and time (F=14.233, p<0.001, η^2=0.456) were identified. When collapsed across group and

235   training, the acute exercise protocol resulted in significant elevations in BDNF concentrations

236   from BL at IP (p=0.001), 30P (p<0.001), and 60P (p<0.001). Circulating BDNF concentrations,

237   when collapsed across group and time, were significantly elevated (p=0.050) from PRE to POST.

238   AUC analysis revealed no significant training x group interaction (F=0.956, p=0.342, η^2=0.053)

239   in the BDNF response between HI and HV (see Fig 2). In addition, no main effect for training

240   (F=2.938, p=0.105, η^2=0.147) or group (F=1.499, p=0.238, η^2=0.081) were noted for the BDNF

241   AUC response.

242   (Insert Fig 1 and 2 here)

243   Relative to BL, plasma volume shifts were not significantly different between the two

244   groups at PRE (p=0.741) or POST (p=0.332). At PRE plasma volume decreased at IP, -8.8 ±

245   8.6%; increased at 30P 5.2 ± 7.7%; and increased at 60P, 4.7 ± 6.4%. At POST plasma volume

246   decreased at IP, -11.9 ± 5.3%; increased at 30P, 3.2 ± 4.0%; and increased at 60P, 5.8 ± 10.4%.

247   Blood variables were not corrected for plasma volume shifts due to the importance of molar

248   exposure at the tissue receptor level.

249

250

251   **Discussion**

252   The primary objectives of this study were to characterize and determine if the BDNF

253   response was different between HI and HV resistance exercise and training. The major findings

254   of this study indicated that BDNF concentrations were significantly elevated following HI and

255   HV resistance exercise in experienced, resistance trained men. In addition, seven weeks of

256   resistance training appears to increase circulating BDNF concentrations in response to the

257   exercise protocol, but did not change resting concentration. This appears to be the first study to

258   compare two commonly used resistance training paradigms on the BDNF response in trained

259   men.

260   Previous research on the acute BDNF response to resistance exercise has primarily

261   utilized untrained individuals, and the results have been inconclusive (7, 18, 35, 43). Similar to

262   the present study, Yarrow and colleagues (43) reported that resistance training can augment the

263   BDNF response to exercise, but not change resting concentrations. Other studies, using

264   previously untrained or recreationally trained participants of similar age were unable to

265   demonstrate any change in the BDNF response to an acute resistance exercise session (7, 18).

266   These differences may be related to the duration or volume of exercise. Correia and colleagues

267   (7) did not observe any change in BDNF concentrations following five sets of 10 repetitions in

268   the isokinetic knee extension exercise, ($60°·sec^{-1}$). Similarly, Goekint et al. (18) used an exercise

269   protocol of three sets of 10 repetitions (80% 1RM) in six different exercises (a total of 18 sets

270   performed), and reported no change in the BDNF response to the exercise stimulus. However,

271   these exercises were all performed with exercise machines. In contrast, the participants in the

272   present study performed four sets of six exercises (a total of 24 sets) using free weight, multi-

273   joint structural movement exercises that recruited a larger muscle mass than the exercises used in

274   the previously mentioned studies. Exercises that recruit a greater amount of muscle mass are

275   associated with a greater endocrine and biochemical response compared to single-joint or

276   confined movement exercises that recruit a smaller muscle mass (23). The difference in

277   musculature recruited may provide a plausible rationale for the difference in the present study

278   and those of Corriea et al. (7) and Goekint et al. (18). It is also possible that a threshold stimulus

279   of volume performed, muscle mass activated, and/or duration of activity is necessary to stimulate

280   a resistance exercise-induced BDNF response.

281   The relationship of BDNF and resistance training has generally been examined in elderly

282   or clinically relevant populations (14-16, 24, 36, 39). Previous research from our laboratory (16)

283   and others (14, 24, 36, 39) have shown that resistance training does not significantly change

284   resting BDNF concentrations. Recently Forti and colleagues (15) reported a significant increase

285   in resting BDNF concentrations in elderly men (> 65 y) who participated in a 3-day per week,

286   12-week mixed, low intensity (60 repetitions at 20% of 1RM, and 10-20 repetitions at 40% of

287   1RM with no rest) resistance training program. However, in that same study no changes were

288   noted in resting BDNF concentrations in elderly men performing low intensity (1 set of 80-100

289   repetitions at 20% of 1RM) or higher intensity (2 sets of 10-15 repetitions at 80% of 1RM with

290   1-min rest between sets) training programs. In addition, no changes were noted in elderly women

291   who participated in all three training programs. Walsh and colleagues (42) reported that 8 weeks

292   of resistance training in older adults (60 – 77 years) was unable to change either resting or the

293   exercise response of BDNF. The ability of resistance training to elevate resting BDNF

294   concentrations may be a function of both age and training status. Younger, and more experienced

295   resistance trained adults appear to not be as sensitive as an older, untrained population to

296   stimulate changes in resting BDNF. However, we observed a significant effect of training on

297 circulating BDNF, supported by the strong effect sizes observed in the temporal (η^2=0.207) and

298 AUC (η^2=0.147) responses. These results are in accordance with Yarrow and colleagues (37),

299 who demonstrated 5 weeks of resistance training was able to alter the BDNF response in

300 untrained men.

301 Increases in circulating BDNF in response to metabolic challenges are suggested to have

302 a role in regulating peripheral energy metabolism within the brain and in peripheral neurons (26).

303 Elevations in circulating concentrations of BDNF resulting from an elevation in metabolic stress

304 does provide support for a duration/volume threshold stimulus (13, 17, 34). Previous research

305 has shown cortisol concentrations to be inversely related to BDNF (2, 21). We have previously

306 reported the cortisol response of the current study (25). The cortisol response at POST was

307 attenuated in HV but not in HI. Although the attenuated cortisol response of HV may explain the

308 increase in circulating plasma BDNF at POST, the similar cortisol response between PRE and

309 POST for HI does not provide support. Therefore, it does not appear that cortisol influenced

310 changes in the BDNF response observed in this study. Additional research is necessary to

311 provide further insight to the mechanism governing BDNF changes to training.

312 The role of circulating BDNF is ambiguous. Much of our present understanding focuses

313 on BDNF's role as a neurotrophin in the brain (40), however, its role in modulating peripheral

314 neurogenesis is less understood. Current evidence indicates plasma BDNF is a proxy marker of

315 BDNF production in the brain (34), however BDNF can also be synthesized peripherally (40).

316 The importance of the resistance training induced increase in BDNF has been suggested to be

317 related to improvements in cognitive function, memory and mood (1, 8, 10). Further research is

318 still needed to delineate the potential physiological role that BDNF has in the neuromuscular

319 system, especially in apparently healthy, trained individuals.

320   **Conclusions**

321   This investigation appears to be the first study to explore the BDNF response to different

322   resistance training paradigms in experienced, resistance trained men. The results of this study

323   demonstrate that the BDNF response is significantly elevated following both the high intensity

324   and high volume training protocols, with no differences between the protocols. In addition, 7-

325   weeks of training did appear to increase the BDNF response to exercise. Future research appears

326   warranted in examining the potential role that elevated BDNF concentrations may have on

327   neuromuscular adaptations.

328

329 **Conflicts of Interest**

332

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466   **Figure Legends**

467   Figure 1. Temporal circulating brain derived neurotrophic factor (BDNF) concentrations at rest

468   (BL), immediately after (IP), 30 minutes after (30P), and 60 minutes after (60P) either a high-

469   intensity, low volume (HI; light line with triangles) or low-intensity, high volume (HV; dark line

470   with squares) resistance exercise protocol before (PRE; A) and after (POST; B) 7 weeks of

471   resistance training. Data are presented at mean ± SD. * = Significant difference compared to BL

472   when groups are collapsed across group and training session. # = Significant difference at POST

473   as compared to PRE when collapsed across time and group.

474   Figure 2. Area under the curve (AUC) of plasma BDNF before (PRE) and after (POST) 7 weeks

475   of either a high-intensity, low volume (HI) or low-intensity, high volume (HV) resistance
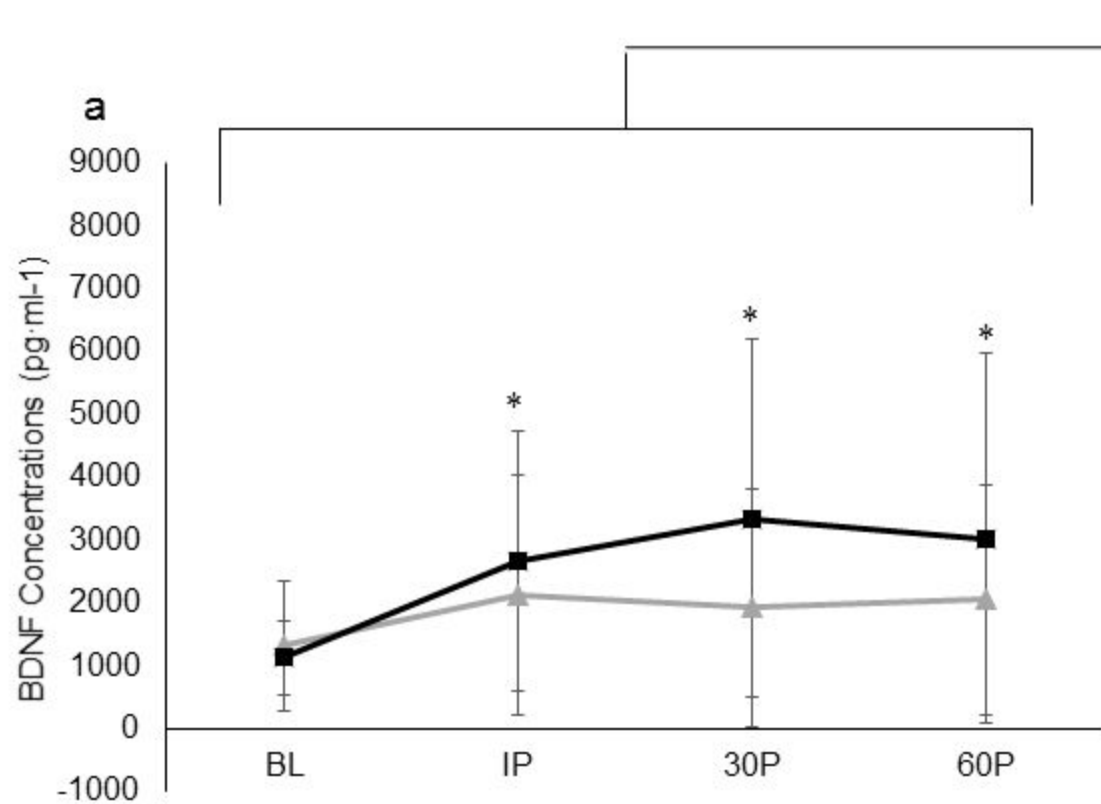
476   training program.

477

Table 1 Resistance training program

Program variable	Preparatory phase both groups	High Volume (HV)	High Intensity (HI)
Exercise prescription			
Training duration	2 weeks	8-weeks	8-weeks
Training intensity	80-85% 1RM	70% 1RM	90% 1RM
Training volume	4 sets x 6-8 repetitions	4 sets x 10-12 repetitions	4 sets x 3-5 repetitions
Rest time	1-2 minutes	1 minute	3 minutes
Exercises			
Day 1	Day 2	Day 3	Day 4
Back squats	Bench press	Back squats	Bench press
Deadlifts	Incline bench press	Deadlifts	Incline bench press
Leg press	Dumbbell flys	Barbell lunge	Incline dumbbell flys
Lat pull downs	Seated shoulder press	Seated row	Seated shoulder press
Barbell bent-over rows	Lateral dumbbell raise	Dumbbell pullover	Lateral dumbbell raise
Barbell biceps curls	Triceps extension	Dumbbell biceps curl	Triceps extension

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