

# Quiz Policies

## **Eligibility**

The NCSF online quizzes are open to any currently certified fitness professional, 18 years or older.

## **Deadlines**

Course completion deadlines correspond with the NCSF Certified Professionals certification expiration date. Students can obtain their expiration dates by reviewing either their certification diploma or certification ID card.

## **Cancellation/Refund**

All NCSF continued education course studies are non-refundable.

## **General Quiz Rules**

- You may not have your quiz back after sending it in.
- Individuals can only take a specific quiz once for continued education units.
- Impersonation of another candidate will result in disqualification from the program without refund.

## **Disqualification**

If disqualified for any of the above-mentioned reasons you may appeal the decision in writing within two weeks of the disqualification date.

## **Reporting Policy**

You will receive your scores within 4 weeks following the quiz. If you do not receive the results after 4 weeks please contact the NCSF Certifying Agency.

## **Re-testing Procedure**

Students who do not successfully pass an online quiz have the option of re-taking. The fees associated with this procedure total \$15 (U.S) per request. There are no limits as to the number of times a student may re-test.

## **Special Needs**

If special needs are required to take the quiz please contact the NCSF so that appropriate measures can be taken for your consideration.

# Quiz Rules

## **What Do I Mail Back to the NCSF?**

Students are required to submit the quiz answer form.

## **What do I Need to Score on the Quiz?**

In order to gain the .5 NCSF continued education units students need to score 80% (8 out of 10) or greater on the CEU quiz.

## **Where Do I Mail My Quiz Answer Form?**

You will mail your completed answer form to:

**NCSF**

**Attn: Dept. of Continuing Education**

**5915 Ponce de Leon Blvd., Suite 60**

**Coral Gables, FL 33146**

## **How Many CEUs Will I Gain?**

Professionals who successfully complete the any continuing education quiz will gain .5 NCSF CEUs per quiz.

## **How Much does each quiz cost?**

Each quiz costs the student \$15.00.

## **What Will I Receive When The Course Is Completed?**

Students who successfully pass any of the NCSF online quizzes will receive their exam scores, and a confirmation letter.

## **How Many Times Can I Take The Quizzes For CEUs?**

Individuals can take each NCSF quiz once for continuing education credits.



# CONCURRENT TRAINING

**S**erious fitness and performance participants routinely battle with the need for concurrent training models which include both anaerobic and aerobic components. Due to the demands of the activity it is valuable to identify the magnitude and intensity of each type of training to optimize the desired performance characteristics without the adverse effects of overtraining. Although the literature has made it obvious that everyone, regardless of age and gender, needs to perform routine aerobic and anaerobic exercise to maintain healthy function and prevent the onset of disease, performance enhancement at the higher levels requires a finer, more specific balance to elicit desired outcomes. There are generally three categories by which concurrent training is emphasized for performance and each requires adjustments and different emphasis to positively synergize adaptations while avoiding cannibalization of performance goals. Concurrent training is often employed to 1) increase competitive aerobic performance, 2) enhance aerobic conditioning to support anaerobic performance, and 3) regulate fat mass while emphasizing lean tissue maintenance and growth.

Regardless of the desired outcome, concurrent training is somewhat of a paradox. Anaerobic training contributes to lean mass gains and stimulates neural enhancements including alterations in preferential recruitment patterns, neural synergy, and enhanced stimulation rate utilizing an oxygen-free metabolic pathway. On the other hand, aerobic

training leads to enhancements in myocardial efficiency, asynchronous fiber recruitment, slow twitch preference and metabolic adjustments in enzyme concentration with concurrent density shifts in the capillaries and mitochondria. The challenge for trainers is to gain the desired response from each system without over emphasizing the complements each provides the other.

When the goal is to improve endurance performance for triathlons, running events and related endurance competitions, aerobic emphasis is on attaining the highest oxygen consumption and lactate threshold, while increasing the power and speed contributions from the anaerobic system. The question is how much anaerobic training is enough to provide benefits without cutting into aerobic volumes and adding stress to incite overtraining and consequential additional recovery requirements. A study analyzing the effects of concurrent explosive strength and endurance training on aerobic and anaerobic performance and neuromuscular characteristics employed high school male distance runners to compare volume differences between groups. Both groups trained at the same total volume but the resistance training group replaced 19% of the aerobic training with resistance training for an 8 week period. The resistance trained group experienced improvements in both maximal anaerobic running speed and 30-meter sprint times above the control group, whereas maximal aerobic speed, maximal oxygen uptake and running economy remained unchanged in

both groups. Likewise, concentric and isometric leg extension forces increased in the resistance trained group, but not in control group. Additional improvements in the experimental group included improved force-time characteristics accompanied by increased rapid neural activation of the muscles and greater quadriceps femoris hypertrophy. These findings suggest that replacing 20% of aerobic training volume with anaerobic training does not negatively impact oxygen consumption or aerobic endurance but can enhance anaerobic components when concurrent explosive strength and endurance training are employed for eight weeks.

Interestingly, when an even greater percentage of aerobic training volume is exchanged with anaerobic, explosive strength training, the outcomes are even more significant. Two groups of competitive, male 5k runners replaced either 32% or 3% of the total training volume with explosive strength training over a 9 week period. Both groups performed a pre-test battery including a 5k time trial, running economy (RE), maximal 20-meter speed, and 5-jump tests. Maximal anaerobic and aerobic treadmill running tests were used to determine maximal velocity and  $VO_{2max}$ . Following the nine weeks, 5K time, running economy and maximal anaerobic speeds improved in the high volume explosive-strength trained group, but no changes were observed in the control group. Additionally, the explosive-strength group improved in 20 meter and the 5 jump tests whereas the control group experienced a decline in the same tests. Of considerable interest, although the  $VO_{2max}$  increased in the control group, and did not change in explosive-strength trained group, the explosive group had greater improvements in 5K run time. Researchers suggest the improvements are most likely attributed to efficiency changes in the neuromuscular characteristics that were transferred into improved rate-velocity and running economy.

To further investigate the effects of improved neural pathways and running economy associated with explosive training researchers applied plyometric training in conjunction with aerobic training. Seventeen male runners were pre- and post-tested for lower leg musculotendinous

stiffness, maximum isometric force output, rate of force development, 5-bound distance, counter movement jump, vertical jump height, running economy,  $VO_{2max}$ , lactate threshold, and 3k time. The test subjects were randomly split into two groups. One group performed 6 weeks of plyometric training in conjunction with their normal aerobic training and the control group trained using the same volume, aerobically. Following the training period, the plyometric trained group experienced significant improvements in 3k performance and running economy at each of the tested velocities without any changes in  $VO_{2max}$  or lactate threshold. Additionally, the group significantly improved in measured vertical jump height, 5-bound jump distance, and musculotendinous stiffness. Again, no significant changes were observed in any measures for the control group. The investigators postulated that the increase in musculotendinous stiffness contributed to improved running economy, speculating that the improvement in running economy led to changes in 3k running performance without alterations in  $VO_{2max}$  or lactate threshold.

It seems the specific mode of explosive training is less important than simply the inclusion of anaerobic training to the improvements. When sprint training was compared to plyometric training at the same volume and relative intensity both modes had comparable outcomes. In fact, investigators suggest that sprint training produces similar or even greater training effects in muscle function and athletic performance than conventional plyometric training. The study provides support for the use of sprint training as an applicable training method of improving explosive performance of athletes in general.

When the effects of endurance training are analyzed for impact on concurrent anaerobic performance the same complement is not identified. Although it is possible to train both energy systems at a moderate level, higher intensity, high volume anaerobic emphasis is negatively impacted by aerobic training, particularly when both are performed at elevated levels. Volumes seem to be an important variable. For instance when 3 days of strength training was compared to 3 days of concurrent training similar adaptations were



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identified. Participants experienced similar anaerobic outcomes regardless of the aerobic activity. When the training volume was increased to 4 days a week for 3 weeks, strength-power training without concurrent endurance training yielded notable increases in force- rate development above the concurrent model but all other parameters remained consistent. According to authors, these studies do not support the concept of the universal nature of the interference effect in strength development and muscle hypertrophy when strength training is performed concurrently with endurance training, and the training volume is diluted by a longer period of time with a low frequency of training. However, the present results suggest that even the low-frequency concurrent strength and endurance training leads to interference in explosive strength development mediated in part by the limitations of rapid voluntary neural activation of the trained muscles.

When increased volume was applied, additional cannibalization was identified. Researchers investigated the neural, endocrine and fiber characteristics of individuals trained specifically for strength or endurance three times a week for 12 weeks and a group who performed concurrent endurance and anaerobic training 6 days a week for the same period. Following six weeks of training the endurance group and concurrent strength-endurance group experienced similar improvements in  $VO_2\max$  whereas leg strength improved consistently in both the strength-only and concurrent strength-endurance groups, with the strength-only group demonstrating the greatest improvements. Additionally, the strength-only group showed improvements in fiber hypertrophy of all fibers at both 6 and 12 weeks, whereas the concurrent training group only found improvements in type II fibers following the 12 week training term, but no significant improvements in any fiber diameter at 6 weeks. Both the endurance only and concurrent training group experienced increases in succinate dehydrogenase (aerobic enzymes that affect mitochondrial capacity) with the endurance-only group decreasing concentrations of adenosine triphosphatase after 12 weeks of training. Additionally, a significant increase in capillary-fiber ratio was

noted after 12 weeks of training in concurrent strength-endurance group. No changes were observed in testosterone, human growth hormone or sex hormone binding globulin concentrations for any group. Authors suggested that based on these findings the evidence supports the contention that combined strength and endurance training can suppress some of the adaptations to strength training and augment some aspects of capillarization in skeletal muscle.



***Although concurrent training is commonly used for performance enhancement in anaerobic and aerobic training it is also a focus of many weight loss programs.***

In a different study, similar group classifications were analyzed for fiber-type transition and related characteristics associated with endurance, strength and concurrent endurance strength training. The strength only and endurance only groups performed training 3 times per week for 12 weeks, while the concurrent training group performed the same strength and endurance training on alternate days. When strength was assessed following 12 weeks the strength only group experienced the greatest improvements in force enhancement; the concurrent training group showed improvements above the endurance only group but did not experience the improvements seen in the strength-only group. Type IIA fibers experienced greater enhancement in the concurrent training group at the expense of faster twitch fibers, whereas the faster twitch fibers were enhanced to a greater proportion in the strength-only group. The strength-only group also induced four-fold increases in the proportion of type I/IIA hybrid fibers whereas the concurrent

training group showed no change. Cross sectional area changes in both the strength-only and concurrent training group increased 16-19% in type IIA fibers. However, the cross sectional increase in type I fibers was 2.9-fold greater in the strength-only group as compared to the concurrent training group after 12 weeks. Investigators suggest that the interference of strength development in the concurrent training group versus the strength-only group was related to greater fast-to-slow fiber type transitions and attenuated hypertrophy of type I fibers.

Although concurrent training is commonly used for performance enhancement in anaerobic and aerobic training it is also a focus of many weight loss programs. Investigators

analyzed the impact of strength, endurance and concurrent training on daily metabolism. Subjects either performed endurance or resistance exercise 3 times per week, or a combination of both at similar volumes. Basal metabolic rate, body fat composition, maximal aerobic power, 1RM bench press and parallel squat were measured before and after the 10-week treatment for each test subject. Additionally, urinary nitrogen was determined pre-, mid-, and post-training.

Following 10 weeks of training the BMR increased significantly from pre- to post-training for the strength training only group (7,613 +/- 968 to 8,090 +/- 951 kJ/day) as well as the concurrent training group (7,455 +/- 964 to 7,802 +/- 981 kJ/day) but not for the endurance-only training group (7,231 +/- 554 to 7,029 +/- 666 kJ/day) which actually declined. Body fat composition shifted positively for the concurrent training group (12.2% +/- 3.5% to 8.7% +/- 1.7%). The almost 4% mean decline was significant compared with the resistance only group which averaged about a 1.5% change (15.4% +/- 2.7% to 14.0% +/- 2.7%) and the endurance only group which reduced by about 2% on average (11.8% +/- 2.9% to 9.5% +/- 1.7%). As is probably expected the maximal aerobic power increased significantly for the endurance group with an average improvement of 13%, whereas the concurrent training group experienced about half the gain (7%) and the resistance only group actual lost an average 0.2% from the starting value. On the other hand, improvements in 1RM bench press and parallel squat were greatest in the strength training only group, yielding improvements of 24% and 23%, respectively compared with the concurrent training group that improved by 19% in the upper body lift but only 12% in the

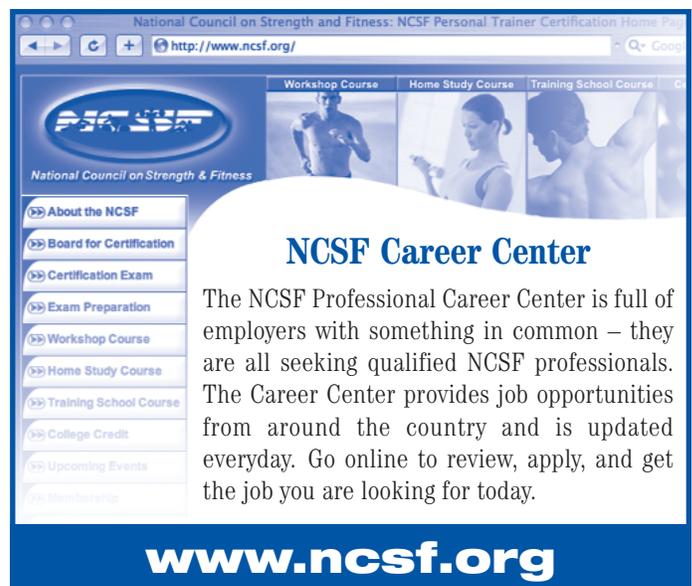
squat assessment. Urinary urea nitrogen loss was greater in the endurance only group by 3% above the other two groups which showed very similar results in protein balance at the end of the 10 week training program. These data indicate that, although strength training alone enhances BMR and muscular strength, and endurance training alone will increase aerobic power and decrease percentage of body fat, concurrent training will provide all of these benefits but to a lesser magnitude than either strength or endurance training when performed independently for 10 weeks.

Based on these studies and others it can be surmised that the specific goal of the training is paramount to the program decisions regarding when to include or exclude concurrent activities in an exercise program. If endurance performance is the goal it should be clear that explosive strength training is an excellent contributor to performance enhancement when used in appropriate volumes. However, if maximal hypertrophy, strength, or power output are the goals then endurance training should be limited in volume and intensity to prevent undesirable shifts in muscle fiber characteristics and enzyme cannibalism. But if health, fitness, and weight loss are the primary goals of the training then concurrent training is the ideal mixture. Personal trainers should realize that most clients do not want to be bodybuilders or extreme strength athletes so the training should reflect this fact. If though someone wants to enhance muscular development, emphasize anaerobic training with reduced volume of endurance training and vice versa if the goals are weight loss or improvements in cardiorespiratory endurance. The reality is everyone needs some level of both, with the actual volumes based on client specific factors.

## Get Certified Now.

Ready for your Exam? What are you waiting for? Scheduling your exam can be done in minutes. You select the date, time, and location of your choice. The NCSF-CPT Exam is available everyday at over 400 test centers throughout the United States and Canada.

*Seating may be limited on select dates.*



The screenshot shows the NCSF Personal Trainer Certification Home Page. The page features a navigation menu with options: Workshop Course, Home Study Course, and Training School Course. Below the menu is a list of links: About the NCSF, Board for Certification, Certification Exam, Exam Preparation, Workshop Course, Home Study Course, Training School Course, College Credit, and Upcoming Events. A prominent banner for the NCSF Career Center is displayed, stating: "The NCSF Professional Career Center is full of employers with something in common – they are all seeking qualified NCSF professionals. The Career Center provides job opportunities from around the country and is updated everyday. Go online to review, apply, and get the job you are looking for today." The website URL [www.ncsf.org](http://www.ncsf.org) is shown at the bottom.

# CEU Quiz

## Concurrent Training

- Which of the following is not one of the three general ways that concurrent training is typically utilized?
  - Increase competitive aerobic performance
  - Enhance aerobic conditioning to support anaerobic performance
  - Regulate fat mass while emphasizing lean tissue maintenance and growth
  - Increase competitive anaerobic performance
- Lean mass gains, neural enhancements specific to preferential recruitment patterns, and enhanced stimulation rate of oxygen-free metabolic pathways describes \_\_\_\_\_ training.
  - Aerobic
  - Anaerobic
  - Endurance
  - None of the above
- When improvement in an endurance event is the goal, aerobic training attempts to accomplish of the following **except** \_\_\_\_\_.
  - Increased oxygen consumption
  - Decreasing power and speed outputs from the anaerobic system
  - Increased lactate threshold
  - Increasing power and speed contributions from anaerobic system
- Research supports the hypothesis that replacing \_\_\_\_\_ of traditional aerobic training with concurrent aerobic and anaerobic training does not negatively impact aerobic performance.
  - 10%
  - 20%
  - 30%
  - 40%
- The study examining 5k runners who participated in concurrent training demonstrated that although an increase of  $VO_2$ max was not achieved, improvements in performance were experienced by the concurrent training group. Why?
  - $VO_2$ max doesn't effect aerobic performance
  - The study didn't examine aerobic performance
  - Improvements in muscular efficiency made thru strength training increased running economy
  - Decreases in  $VO_2$ max resulted in greater run times.
- Based upon the research information, the **specific mode** of anaerobic training is the primary determinant of outcomes when implemented into a concurrent training program.
  - True, it is important to choose either plyometric training or sprint training
  - False, the inclusion of any type of anaerobic training is important, not the specific mode
  - False, plyometric training is the only type of anaerobic training in a concurrent program that is beneficial.
  - None of the above are correct because concurrent training is detrimental to improved aerobic performance.
- When attempting to improve anaerobic performance, \_\_\_\_\_ is very important, as evidenced by the fact that when strength training frequency increases from 3 days/week to 4 days/week notable improvements in force-rate development are observed.
  - Volume
  - Intensity
  - Duration
  - None of the above
- \_\_\_\_\_ training can improve aerobic performance via increased contributions from the anaerobic system, however anaerobic performance cannot be \_\_\_\_\_ through the use of concurrent training.
  - Aerobic; maximized
  - Sprint; minimized
  - Aerobic; improved
  - Concurrent; maximized
- Evidence supports the idea that a combination of \_\_\_\_\_ training can suppress some of the adaptations to strength training and augment some aspects of capillarization in skeletal muscles (aerobic adaptation).
  - Strength and endurance
  - Flexibility and endurance
  - Strength and power
  - Power and flexibility
- Which of the following characteristics of a weight management/health improvement program can be achieved with concurrent training?
  - Reduction of body fat %
  - Increase in Basal Metabolic Rate (BMR)
  - Increase in maximal aerobic power
  - All of the above are possible with concurrent training

# Quiz Answer Form

FIRST NAME \_\_\_\_\_ LAST NAME \_\_\_\_\_ M.I. \_\_\_\_\_

TITLE \_\_\_\_\_

ADDRESS \_\_\_\_\_ APT. \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

COUNTRY \_\_\_\_\_ POSTAL CODE \_\_\_\_\_

CERTIFICATION NO. \_\_\_\_\_ CERTIFICATION EXP. \_\_\_\_/\_\_\_\_/\_\_\_\_

MEMBERSHIP NO. \_\_\_\_\_ MEMBERSHIP EXP. \_\_\_\_/\_\_\_\_/\_\_\_\_

| Quiz Name | Member Price | Total |
|-----------|--------------|-------|
|           | \$15         |       |



Discover



Visa



Mastercard



Amex



Check/Money Order

Account No. \_\_\_\_\_

Exp. Date \_\_\_\_\_

Security Code \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

## Quiz Answers

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

Fill in each blank with the correct choice on the answer sheet. To receive 0.5 CEUs, you must answer 8 of the 10 questions correctly.

Please mail this Quiz answer form along with the proper enclosed payment to:

NCSF  
5915 Ponce de Leon Blvd., Suite 60  
Coral Gables, FL 33146

Questions? 800-772-NCSF