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.

Carb Loading Reviewed

Carbohydrates stored in the muscle and liver are important for both anaerobic and endurance performance. The form of carbohydrate stored in the tissue is glycogen, a polysaccharide of glucose stored with phosphates and water in a 1:3 ratio. Muscle glycogen provides the necessary fuel for energy metabolism in striated muscles, while liver glycogen supplies glucose to other cells and maintains blood glucose levels for brain function. During exercise, muscle tissues begin to use glycogen while the liver releases glycogen into the blood at a proportional rate to thwart hypoglycemia. Fatigue during endurance events or prolonged anaerobic activity has been associated with low glucose levels in the muscle and in the blood. However, the body does not simply "run out" of glycogen and then "turn off" like a car running out of gas. If that were the case, active muscle would fall into a state of rigor-mortis as glycogen depleted from the system. Rather, fatigue has an onset characteristic that yields signs and symptomatic evidence as it increases in magnitude.

Fatigue during exercise is influenced by a complex interaction between peripheral and central nervous system factors. However, the duration of exercise maintained at a given intensity is related to the relative level of glycogen stores in the active tissue. For example, if a person runs at an 8-minute per mile pace, eventually the run feels more difficult, even without alterations to pace or terrain resistance due to the energy contributions from carbohydrates. In this regard, scientists have found a linear relationship between a person's perceived exertion (RPE) and their level of muscle glycogen. As muscle glycogen is depleted during a training bout, exercise will "feel" more difficult, and RPE will increase.

Concurrently, other fatiguing factors contribute to performance decline, such as signals which turn off enzymes that convert glycogen to energy and signals that increase the liver's ability to make glycogen from other sources such as proteins. The drop in the blood levels of branched chain amino acids has been linked to altered brain chemicals (i.e. serotonin and dopamine). Some studies suggest that this drop in branched chain amino acids will alter one's mood in favor of "relaxation" over feelings of "excitation." Therefore, an athlete would rather stop exercising at this point and rest than continue, often called "hitting the wall". A higher ratio of the chemical serotonin to the chemical dopamine in the brain is associated with feelings of tiredness and lethargy, hastening the onset of fatigue, whereas a low ratio favors improved performance through the preservation of arousal and motivation. Moreover, fatigue has been shown to occur when glycogen levels experience further diminution and the pain associated with exercise exceeds the reward of continuing the activity, a condition ultimately leading to the cessation of training. Finding a way to keep glycogen levels elevated in the muscle allows for a delayed onset of fatigue, whether it be due to reduced pain with exercise (peripheral), preserved balance of brain chemicals (central), or a combination of both.

Given this information, much attention has been focused on methods to increase glycogen stores prior to prolonged exercise (~ >90 minutes). Since the mid-1900s various methods have been employed by athletes and investigated by scientists. The "classical method" involved an initial phase of approximately 3 days of glycogen depletion by eating an Atkins-type (low carb) diet and exercising to exhaustion. This phase is followed by a period of high carbohydrate intake and reduced activity (~3 day taper). The newer methods do not involve a depletion phase, just reduced training and increased carbohydrate intake during a taper. Although the newer methods typically lead to less glycogen loading than the depletion-first methods, some believe that increase is sufficient to improve performance, without the potential side effects associated with the depletion phase (mood swings, symptoms of overtraining, potential of reduced immune function, etc…). As a result, many scholars/coaches/dieticians have recommended the newer methods in recent years.

Anecdotal performance evidence comparing the classical and new carbo-loading techniques has lead to a split decision by some practitioners. The preference of the older method may be attributed to the difference that sometimes exists between people who discuss exercise physiology and those who practice it; or the difference between scientific findings that are "statistically significant," and those that are "practically significant." Indeed, the subjective evidence is abundant; many athletes have migrated back to the classic method after finding the new method to not be as effective. Likewise, bodybuilders who practice the depletion method followed by carbo-loading to gain muscle mass for competitions have used the classic method for decades and claim such obvious and successful results that performing carbo-loading without depletion is rarely debated. Clearly, by just increasing carbohydrate intake alone without depletion-first they fail to see nearly the same amount of increases in body mass (remember for every 1 gram of glycogen stored there is almost 3 grams of water stored with it).

Interestingly, practice-based outcomes have led some investigators to revisit the traditional method of carbo-loading once again providing support of the classical depletion-first method. This may be due to advances in the means by which we can measure muscle carbohydrate levels. Many studies measure glycogen using muscle samples drawn via a needle called muscle biopsies. Some problems with these studies is that there are typically a small sample-sizes of participants, and involve a small number of biopsies taken (~3-4 times per subject). Moreover, biopsies taken from a muscle, even a small area (< $10cm^2$) reduces the muscle's ability to store glycogen. This is a major and ironic confounding variable when the aim of such studies is to quantify muscle glycogen stores in response to dietary and training strategies.

Alternatively, new studies use a technique called nuclear magnetic resonance spectroscopy which exploits the magnetic properties of certain cell nuclei. This technique can identify carbon atoms in an organic molecule and has become an important method for understanding aspects of organic chemistry such as fuel levels in muscle. In contrast to the biopsy technique, this method allows for frequent, repetitive and non-invasive measurements which will not traumatize the muscle being studied.

Recent studies using this technology have clearly shown that a depletion phase promotes greater glycogen storage which lasts for a longer period of time than carbo-loading without a depletion phase. In support of earlier research, it appears that the depletion phase increases glycogen stores via 3 main pathways: 1) increased ability to uptake glucose; 2) increased storage rate; and 3) preferential fat metabolism and reduced glycogen oxidation (usage) rates. Recent research demonstrates that glycogen-depletion directly increases the capacity of a muscle to uptake glucose by increasing the expression of glucose transporters. It has been found that muscle contraction occurring when glycogen stores are low increases an enzyme (AMPK alpha 2 isoform) which moves to the muscle cell nucleus to increase the synthesis of specialized transporters of glucose inside the muscle cell. Basically, the muscle gets better at pulling glucose out of the blood in an attempt to restore glycogen content. A concomitant increased glycogen storage rate occurs due to increases in the activity of the enzyme that stores glucose as glycogen in your cells (glycogen synthase). This enzyme is activated by low levels of its substrate (glycogen). The depletion phase lowers glycogen stores, causing the enzyme to be more active. The increased activity can dramatically increase the rate of glycogen storage in the subsequent carbo-loading phase (supercompensation). Thirdly, glycogen depletion may also evoke a shift in fuel oxidation, favoring fat over carbohydrate metabolism during prolonged exercise. This effect seems to involve up- and down-regulation of key regulatory enzymes in the pathways of skeletal muscle fat and glycogen metabolism, respectively. For example, after glycogen depletion the activity of enzymes that harness fat from storage (hormone-sensitive lipase) increase while the activity of enzymes which harness energy from glycogen in the muscle (pyruvate dehydrogenase) decrease. This adaptation may be preserved over the course of a brief taper period during carbo-loading and may ultimately help preserve glycogen levels for a longer period of time during endurance exercise.

Carb Loading Reviewed Quiz

1. What is the storage form of carbohydrates in the muscle and liver?

    a. Glucose
    b. Glycogen
    c. Glycerol
    d. Glycine

2. Low levels of glucose in the blood during prolonged anaerobic events has been linked with:

    a. Improved performance
    b. Increased power output
    c. Increased fatigue
    d. Increased muscle mass

3. Due to the linear relationship between muscle glycogen and RPE, exercise at a constant intensity will _________ as the training bout progresses.

    a. Become easier due to more available glycogen
    b. Become more difficult due to less available glycogen
    c. Become more difficult due to more available glycogen
    d. Become easier due to less available glycogen

4. In addition to depleted glycogen stores, decreased amounts of ________ can lead to alterations of certain brain chemicals and ultimately fatigue.

    a. Branched chain amino acids
    b. Enzymes that convert glycogen to energy
    c. Signals that increase liver glycogen production
    d. All of the above are correct

5. Increased feelings of tiredness and lethargy are experienced when ___________

    a. There is a higher ratio of serotonin relative to dopamine
    b. There is a higher ratio of dopamine relative to serotonin
    c. There is equal amounts of dopamine to serotonin
    d. None of the above

6. One of the primary methods to delay the onset of fatigue is to _________

    a. Minimize glycogen stores by fasting
    b. Maximize fat storage for energy utilization
    c. Maximize glycogen stores
    d. Maximize protein stores

7. The "classic" method of increasing glycogen storage involves which of the following cycles?

    a. Increased activity with increased carbohydrate intake followed by decreased activity with decreased carbohydrate intake
    b. Decreased activity with decreased carbohydrate intake followed by increased activity with increased carbohydrate intake
    c. Increased activity with decreased carbohydrate intake followed by decreased activity with increased carbohydrate intake
    d. None of the above represent the "classic" method

8. Due to a reduced occurrence of side effects such as mood swings, and potential immune function decline, the "newer" method of glycogen does not involve ______.

    a. A reduced level of activity
    b. A carbohydrate depletion phase at the start
    c. An increase in glycogen stores
    d. Reduced training and increased carbohydrate intake during the taper

9. Which of the following is a positive attribute of the newer nuclear magnetic resonance imaging techniques used to measure glycogen levels?

    a. Allows frequent testing
    b. Non-invasive
    c. Will not traumatize the studied muscle
    d. All of the above are correct

10. After a glycogen depletion phase, the activity of hormones that harness ______ from storage for energy utilization increase, while the enzymes that harness energy from glycogen in the muscle _______, ultimately leading to increased glycogen storage

    a. Sugar; decrease
    b. Fat; increase
    c. Fat; decrease
    d. Sugar; increase

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