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Resistance Training: Nutrient Timing in Terms of Protein Consumption

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Abstract

Objectives: Nutrient timing is a topic of interest that has been discussed frequently in recent years. From a historical perspective, nutrient timing has often been interpreted as synonymous with carbohydrate intake. However, trying to understand the concept of nutrient timing under the title of carbohydrate loading will be quite inadequate. Today, advances in the sciences of nutrition and exercise offer valuable results, especially about the timing of nutrients before, during, and after training. Nutrient timing is commonly practiced by both coaches and athletes. Therefore, this paper will first present scientific information about the timing of protein consumption, especially for those involved in resistance training. In this context, the effects and possible mechanisms of protein consumption before, during, and after resistance training will be explained first. Besides, possible results will be shared about the types of protein that have been discussed frequently recently. **Results:** In conclusion, although nutrient timing is a controversial issue, it is essential for optimal training performance. Nutrient timing has the potential to influence physiological adaptations in terms of both total health and sporting performance. Consumption of protein and carbohydrates in combination before, during, and after training not only causes a decrease in protein degradation but also an increase in protein synthesis. **Conclusion:** Finally, nutrient timing has the potential to have a different effect on people who exercise regularly or on athletes. Therefore, individuals should try to determine the nutrient timing strategy that is optimal for them. However, further research is needed to better clarify nutrient timing.

Keywords: Nutrition, Timing, Protein, Recovery, Performance

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Introduction

Nutrient timing is a topic of interest that has been discussed frequently in recent years. From a historical perspective, nutrient timing has often been interpreted as synonymous with carbohydrate intake. It has been used alone instead of carbohydrate intake or carbohydrate loading. This false idea dates back to the 1928 Olympics when marathon runners consumed carbohydrates before the races. Although nutrient timing has been adopted by some athletes and coaches after this date, it took time for a scientifically systematic approach to develop. A thorough search of the relevant literature will show that since the 1960s, carbohydrate loading (which is very common, particularly among distance runners) has been well documented. Since then, many studies have stressed that carbohydrate loading will help both regenerate muscle and liver glycogen stores (Bussau et al., 2002; 2002; Goforth et al. 2003; Kavouras et al., 2004; Sherman et al. 1981; Yaspelkis et al. 1993) and maintain blood glucose levels (Coyle et al., 1986; Kavouras et al., 2004; Campell and Spano, 2011).

However, trying to understand the concept of nutrient timing under the title of carbohydrate loading will be quite inadequate. Today, advances in the sciences of nutrition and exercise offer valuable results, especially about the timing of nutrients before, during, and after training. Nutrient timing is commonly practiced by both coaches and athletes. However, the approach followed in particular on nutrient timing practices does not go beyond interpretations that have no scientific basis. Therefore, the discussion of nutrient timing in the light of scientific knowledge will provide unique contributions to both literature and the field. Also, when the relevant literature is examined, it can be seen that although there are a lot of studies on the timing of carbohydrate intake, the timing of protein consumption has been scarcely investigated. Therefore, this paper focuses on explaining the mechanisms of the timing of protein consumption. This aspect of the research will make unique contributions to the literature.

Increases in the number of people involved in resistance training in recent years are interpreted as pleasing for the improvement of public health and increasing exercise habits. Despite these positive developments, people involved in resistance training often tend to believe in legends about nutrition. Protein consumption and timing is one of the most discussed topics among people involved in resistance training. Typically, about the amount and timing of protein consumption, people tend to believe in hearsays, which are usually far from scientific reality. Therefore, this paper will first present scientific information about the timing of protein consumption, especially for those involved in resistance training. In this context, the effects and possible mechanisms of protein consumption before, during, and after resistance training will be explained first. Besides, possible results will be shared about the types of protein that have been discussed frequently recently.

Protein Consumption Before Training

Many people try to meet most of their daily protein needs before resistance training. It is thought that by doing so, they aim to optimize protein synthesis for increased intramuscular and extramuscular anabolic processes induced by resistance training (Coburn et al., 2006; Cribb and Hayes, 2006; Kraemer et al., 2007; Tipton and Wolfe, 2001; Willoughby et al., 2007) and to minimize possible muscle (protein) degradation (Kraemer et al., 2007; White et al., 2008). A study investigating pre-workout protein consumption emphasized that consuming 20 g of protein before resistance training for ten weeks could lead to increases in lean body mass, strength, and some muscle hypertrophy markers after ten weeks (Willoughby et al., 2007). It was emphasized in the same study that carbohydrate (20 g) consumed together with 20 g protein has the potential to affect more anabolic hormones and intramuscular hypertrophic markers. Similarly, another study reported that protein consumption before resistance training could lead to increases in lean muscle mass, 1-RM strength scores, and type II muscle fiber (Cribb and Hayes, 2006). However, it was also stated in these studies that current fitness levels, training background, and nutritional status of those involved in resistance training might be effective in this positive effect. In contrast, another study claimed that consuming 21 g of protein before and after resistance training would not lead to any positive effects (Hoffman et al., 2009). In a study conducted in 2007, Tipton et al. reported that protein or amino acids consumed in combination with carbohydrates 30 minutes before resistance training resulted in increases in muscle protein synthesis. Besides, pre-workout amino acid consumption was determined to cause more muscle protein synthesis than post-workout amino acid consumption (Tipton et al., 2001; Campell and Spano, 2011). The rational cause behind this may be the potential of pre-workout protein intake to contribute to the optimization of intramuscular hypertrophic processes.

In conclusion, although the literature findings are controversial, consuming approximately 20 grams of protein or amino acid before resistance training may have positive effects on both strength and hypertrophy parameters.

Protein Consumption During Training

The number of studies that have investigated the possible effects of nutrient consumption during resistance training is very limited. However, it is claimed that carbohydrate or protein consumption during resistance training will contribute to the maintenance of muscle glycogen stores and the prevention of muscle degradation (Haff et al., 2000; Bird et al., 2006).

Haff et al. (2000) determined that 1 g carbohydrate intake per kg before and during (every 10 min) resistance training provided a higher muscle glycogen level (49% higher according to biopsy results) compared to the placebo group. In a research design in which both carbohydrate and protein were consumed in combination during resistance training, cortisol, which has the potential to affect protein degradation level, was found to be higher in the group that did not receive nutrients (105%) (Bird et al., 2006). Similarly, in another study, it was claimed that carbohydrate and protein consumed in combination during (every 15 minutes) a 2-hour training could reduce protein degradation and increase protein synthesis rate (Beelen et al., 2008). Also, Bird et al. (2006b) emphasized that the consumption of carbohydrates and amino acids together would have a positive effect on protein degradation and muscle mass gain compared to the placebo group. The literature review indicates that the consumption of carbohydrates and proteins in combination during resistance training is a more effective strategy. It has been stated that carbohydrate and protein consumption during resistance training will increase serum insulin and cortisol levels and also cause decreases in protein degradation (Bird et al., 2006b). Amino acids and proteins consumed during resistance training also have the potential to influence the cross-sectional area of skeletal muscles. It was also reported in the study mentioned above that after 12 weeks of resistance training, there was an increase in both type 1 and type 2 muscle fibers in the group that consumed nutrients, compared to the placebo group (Campell and Spano, 2011).

To sum up all these findings, it has been reported that the consumption of carbohydrate alone or combination of carbohydrate + protein during resistance training will maintain muscle glycogen stores and cause increases in skeletal muscle cross-sectional area and decrease in protein degradation level (Bird et al., 2006a, 2006b, 2006c; Haff et al., 2000). In fact, those involved in resistance training can take both carbohydrate and protein (amino acid) together during training. These nutrients taken during resistance training will help maintain and restore muscle glycogen stores. These nutrients will also contribute to the reduction of catabolic processes (such as protein degradation) and increase anabolic processes (such as protein synthesis).

Protein Consumption After Training

People involved in resistance training usually consume protein after workout. The reason for this commonly adopted habit is shown to be the stimulation of protein synthesis and degradation after resistance training (Phillips et al., 1999; Pitkanen et al., 2003). Nutrient intake after resistance training is known to have positive effects on protein synthesis and degradation (Phillips et al., 1999). Also, it has been stated that amino acids consumed after resistance training will cause an increase in plasma amino acid levels (Biolo et al., 1997; Borsheim et al., 2002). In support of this opinion, it was also emphasized that carbohydrates (between 20 and 40 g) consumed in combination with amino acids (between 6 and 12 g) after resistance training would increase protein synthesis (Tipton et al., 2001). In this context, the presence of sufficient amino acids in the bloodstream after resistance training is essential for increasing lean body mass (Biolo et al., 1997; Tipton et al., 1999a). When nutrient preference after resistance training is examined from another perspective, the literature draws attention to carbohydrate consumption. It has been reported that the intake of large amounts of carbohydrates (around 100 g) after high-intensity resistance training leads to a balance between protein production and degradation (Borsheim et al., 2004). No study has been conducted until now that has reported that carbohydrate consumption is not the right choice after resistance training. Moreover, the potential of carbohydrate consumption to increase glycogen resynthesis after resistance training is frequently emphasized (Ivy et al., 2002; Tarnopolsky et al., 1997). In light of this information, instead of protein consumption alone, consumption of carbohydrates in combination with protein will be a more effective strategy after resistance training.

Amino acid consumption after resistance training is an important strategy that has been studied. Therefore, the amount of amino acid to be consumed after resistance training is crucial. The most crucial problem in terms of amino acid consumption is the critical threshold for muscle protein synthesis. The literature recommends an average consumption of between 6 and 40 g of essential amino acids for optimal muscle protein synthesis (Borsheim et al., 2002; Miller et al., 2003). In addition, it is emphasized that amino acids should be consumed in combination with carbohydrates in order to increase the effect level (Tipton et al., 2001). The logical explanation for this might be that consumption of carbohydrate and amino acids is extremely important for the restoring of muscle glycogen stores and muscle regeneration after intensive and strenuous resistance training (Tipton and Wolfe 2001). Also, when these recommended nutrients should be consumed is another controversial topic. Some studies have reported that amino acid consumption immediately after resistance training or within 3 hours has the potential to increase muscle protein synthesis (Borsheim et al., 2002; Miller et al., 2003). However, the optimal timing of amino acid consumption has not been clearly determined to date. However, most exercise scientists have emphasized that nutrient intake immediately after resistance training (as soon as possible) is the most optimal strategy (Ivy et al., 2002; Tipton and Wolfe, 2001). It has been stated that amino acid consumption with or without carbohydrates in the 1st, 2nd, and 3rd hours after resistance training is vital for protein balance (Borsheim et al., 2002; Ivy et al., 2002; Tipton et al., 1999b, 2001; Tipton and Wolfe, 2001).

The type of proteins consumed after resistance training is also an interesting issue. Therefore, there is a paradox among people involved in resistance training about the type of protein consumed after training. As mentioned above, the studies have emphasized the importance of protein consumption after resistance training for increasing protein synthesis. However, it is also crucial to determine which type of protein is the optimal choice for nutrient timing. The literature emphasizes the potential of protein consumption in combination with carbohydrates to influence the kinetics of amino acids and adaptation to resistance training (Boirie et al., 1997; Dangin et al., 2001; Kerksick et al., 2007). In the literature, it is stated that the type of protein consumed (casein or whey) may cause differences in the digestion. Some studies have determined that whey protein has a higher digestibility rate or higher rate of absorption in the bloodstream than casein protein. These differences in favor of whey protein are thought to have a positive effect on the protein synthesis mechanism. In support of this opinion, whey protein has more essential amino acid content than casein. On the other hand, the casein protein has been reported to have a more significant effect on total body protein balance (Boirie et al., 1997; Dangin et al., 2001). Based on these, it can be concluded that both casein and whey proteins should be consumed after resistance training. It has also been reported in the literature that consumption of whey and casein proteins in combination is a more effective strategy for increasing total muscle mass after ten weeks of resistance training (Kerksick et al., 2007; Campell and Spano, 2011). In light of all this information, we can argue that consumption of whey protein alone or consumption of whey or casein proteins in combination after resistance training is important for protein synthesis optimization. Furthermore, consumption of whey and casein proteins in combination after resistance training can be a highly effective strategy for increasing total muscle mass.

Practical Implications

In conclusion, although nutrient timing is a controversial issue, it is essential for optimal training performance. Nutrient timing has the potential to influence physiological adaptations in terms of both total health and sporting performance. Nutrient timing is an important strategy for optimal nutrition, especially for people involved in resistance training. Consumption of protein and carbohydrates in combination before, during, and after training not only causes a decrease in protein degradation but also an increase in protein synthesis. Besides, consuming both whey and casein proteins in combination after resistance training is a highly practical application that provides an increase in total muscle mass. Finally, nutrient timing has the potential to have a different effect on people who exercise regularly or on athletes. Therefore, individuals should try to determine the nutrient timing strategy that is optimal for them. However, further research is needed to better clarify nutrient timing.

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