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Abstract: The word carbohydrates can be traced back to Germans, who called them “Kohlen hydrates”. It was then termed carbohydrates in English. ‘Carbo’ means that they contain carbon, ‘hydr’ means that they contain hydrogen and the third part of the name ‘ate’ mean that they contain oxygen. The ratio of hydrogen atom to oxygen atoms is 2:1. Carbohydrates are actually the organic compounds that are important for body functions. Carbohydrates are much abundant in plants, rather than in animals. Animals utilizes carbohydrates in the form of food. Muscle hypertrophy is an important factor for athletic performance. This study attempts to detailed discussion on importance of carbohydrates in muscle hypertrophy.

Key words; sports nutrition, carbohydrates, muscle hypertrophy

INTRODUCTION

“Nutrition may be defined as the sum total of the process by which the living organism receives and utilizes the food materials necessary for growth, maintainance of life, enhancing metabolic process, repair and replacement of worn out tissues and energy supply” (Z S C Okoye). sports nutrition research started in 1960’s at Ball state university under direction of Dr David Costil. Sports nutrition is the study and practice of nutrition and diet as it relates to sports performance. It deals with the nutrients such as vitamins, minerals, carbohydrates, fats and protein. Carbohydrates are the polyhydroxy aldehydes or ketones or these are the compounds which on acidic hydrolysis give polyhydroxy aldehydes or ketones. They contain carbon, hydrogen and oxygen molecule. Carbohydrates are classified in to three categories, monosaccharides, oligosaccharides and polysaccharides. The main difference between the type of carbohydrates is actually the difference between their chemical composition. Compared to complex carbohydrates, simple carbohydrates have smaller chain of chemical composition. Muscle hypertrophy is an increase and growth of muscle cells and it is achieved through physical exercise. There are two types of muscular hypertrophy, myofibrillar and sarcoplasmic muscle hypertrophy.

OBJECTIVES OF THE STUDY

- To discuss functions of carbohydrates in terms of muscle hypertrophy.
- To discuss importance of carbohydrates in muscle hypertrophy.

STATEMENT OF THE PROBLEM

Carbohydrates are important fuel for physical exercise. The purpose of this study was detailed discussion on importance of carbohydrates in muscle hypertrophy and discussing the functions of carbohydrates in terms of muscle hypertrophy.

REVIEW OF LITERATURE

Amy R Lane et.al (2010, April) found influence of dietary carbohydrate intake on the free testosterone: cortisol ratio, response to short term intensive exercise training. William J Kraemer et.al (2017) found recovery responses of testosterone, growth hormone and IGF-1 after resistance exercise. Moller N Jorgensen J.O(2009) found effects of growth on glucose, protein and lipid metabolism in humans. M Wholever T.M, Br J Nutr. (2000 March) found dietary carbohydrates and insulin action in humans. Alghannan A F et.al (2016) found influence of post exercise carbohydrates protein ingestion on muscle glycogen metabolism in recovery and subsequent running exercise. Ivy J L et.al (2002) found influence post exercise carbohydrate, protein ingestion in subsequent running exercise. Classey J. L et.al (2001) found abdominal visceral fat and fasting insulin are important predictors of 24-hour GH release independent of age, gender, and other physiological factors.

DISCUSSIONS

Discussions on importance of carbohydrates in muscle hypertrophy

Carbohydrates are the most abundant organic molecule in nature and primary source of energy in humans. General formula of carbohydrates are $C_n(H_2O)_n$. sugars are simple forms of carbohydrates. polysaccharides such as starch and fibre are complex forms of carbohydrates. The smallest carbohydrates are monosaccharides such as glucose and fructose. These compounds which do not break down in to simpler compounds on hydrolysis. The body breaks down most sugars and starches in to glucose. Sports persons rely carbohydrates for sustained energy, preventing fatigue and enhancing athletic performance.

Strength is an important component for athletic performance. Strength is highly improved through resistance training. Muscle cross section (muscle size), muscle fiber spectrum, coordination, energy supply, body weight and psychic factors directly affected muscle strength, so muscle hypertrophy is an important factor for sports performance. Mainly athletes achieved muscle hypertrophy through resistance training. isometric, isotonic and isokinetic resistance training improves muscle hypertrophy. Progression of training and proper nutrition also helps to improve muscle size. Sarcoplasmic muscle hypertrophy and myofibrillar muscle hypertrophy are two types of muscle hypertrophy. Myofibrillar muscle hypertrophy increases strength and speed and activates contractor muscle. Sarcoplasmic muscle hypertrophy increases energy storage and endurance and activates glycogen storage in muscles. The energy for muscle hypertrophy is primarily obtained through the breakdown of phosphogens (ATP-CP). The amount of phosphogens stores is therefore important for strength performance. Testosterone production, human growth hormone, immune system, cortisol and IGF-1 production directly influenced on muscle hypertrophy.

Protein sparing is the process by which the body derives energy from sources other than protein. Protein sparing effect helps to protect muscle proteins. According to classical studies of Munro (1964) administration of carbohydrates has a protein sparing effect in the fasting subjects, whereas fat does not have this effect. In this process body take glycogen for energy instead of breaking down muscle tissue for energy. Combination of carbohydrates with protein supplements produces greater anabolic response than protein alone.

Muscle is harder to build due to lower testosterone levels in athletes. For adult men and women regular resistance exercise are key to building and keeping muscles. Testosterone is an androgen. testicles produced large amount of testosterone in men, as well as small quantities produced by the adrenal gland in both men and women. The pituitary gland control testosterone production. Pituitary gland produces luteinizing hormone or LH. Which stimulates testicles and create more testosterone. Carbohydrates are essential for testosterone production. Studies shows that high carb and low protein diet improves free testosterone levels and low carbohydrates diet increases cortisol level (stress hormone). Cortisol negatively affected muscle hypertrophy and increases muscle catabolism.

Insulin is an important hormone in human body and also called the evil storage hormone. Insulin is released by pancreas, mainly related to intake of carbohydrates and insulin that causes cell to absorb glucose from the blood and used it for energy. Insulin helps to regulate blood sugar level by assisting the cells that absorb sugar from blood stream and it is a very powerful muscle building hormone, it shuttles glucose and amino-acids to the cells. Insulin act like a stimulator of muscle hypertrophy and it is an anabolic stimulus for muscle proteins. Insulin directly stimulate the cellular pathway in the muscle that regulate muscle growth and triggers sodium ion and potassium ion pump to allow amino-acids to enter and be turned in to protein. Also helps to promote blood supply towards muscles it helps to reach more oxygen and nutrients into muscle.

Growth hormone is a protein hormone and secreted by cells called somatotrophs in the anterior pituitary gland.HGH helps to growth and metabolism. The HGH stimulate the liver and other tissues to secrete IGF-1. IGF-1 is a key player in muscle growth. It stimulates both the differentiation ad proliferation of myoblasts. It also stimulates amino acid uptake and protein synthesis in muscle cells. Growth hormone show anti-insulin activity, supresses the abilities of insulin to stimulate uptake of glucose in peripheral tissues. Exercise, nutrition, sleep and stress affected production of growth hormone. Insulin and HGH mutually regulate the secretion of each other. The balance between

insulin and HGH is associated with substrate and energy metabolism, but in case of protein metabolism they synergistically act each other. Research suggests that insulin may dictate the secretion of HGH. Consistent increase in insulin level prevent HGH production and reducing the level of HGH in body. In case of obesity, insulin is high and lower levels of HGH leads to further build-up of fat and affect muscle hypertrophy. Along with directly affecting insulin production excess sugar intake enhances weight gain and obesity, which also affect HGH levels.

“A new study shows that, following muscle injury, certain immune cells produce a protein called GDF3 that enhances formation of new muscle cells” (Laszlo Nagy. D, PhD, genomic control of metabolic program). Exercise is a form of stress and more vigorous physical exercise develops more physiological and biochemical changes in human body. Prolonged strenuous physical exercise challenging immune system and causes immune-depression. Consuming carbohydrates immediately after strenuous exercise also helps to restore immune function. This is especially important in situations where the recovery duration between the two consecutive exercise sessions in short, which is often the case for athlete (Dr Oliver Neubaver). Intake of carbohydrates during or immediately after exercise reduces exercise related immuno-depression and helps the body to recover. Well balanced diet helps to maintain immune function following longer duration physical exercise.

CONCLUSION

Carbohydrates are neutral chemical compounds and produced 4 calories of energy per gram energy. Humans stores carbohydrates in the form of glycogen and uses this nutrient for energy. Carbohydrates play key role in the metabolism of amino-acids and fatty acids. Intake of carbohydrates are important for immune function, testosterone production and also controls production of stress hormone cortisol. Production of Insulin directly related to intake of carbohydrates. Elevated insulin level may reduce HGH production. HGH is an important hormone for muscle hypertrophy. Insulin and glucagon ensure that cells throughout the body, and especially in the brain have a steady supply of blood sugar. Reduction in sugar intake also leads to an increase in HGH production.

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