LARGE VS. SMALL MUSCLE MASS ACTIVITY IN RHYTHMIC EFFORT pdf

1: Gastrointestinal (GI) Motility

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Many patients are often unaware that an episode is occurring or has occurred. The rhythmic movements may produce some bodily injury via falls or muscle strains, but this is not reported in all patients [4]. In unique cases, RMD sufferers hum or moan while asleep during an episode. Some patients describe the repetitive movements as relaxing and are only occasionally awakened by an RMD episode. Additionally, it is often the partner or parent who led patients to seek medical attention. Motor symptoms[edit] Symptoms of rhythmic movement disorder vary, but most sufferers share common large muscle movement patterns. Many sufferers show consistent symptoms including: Other less common muscle movements include: Usually, the head strikes a pillow or mattress near the frontal-parietal region. There is little cause for alarm at the movements as injury or brain damage as a result of the movements is rare. Some infants with diagnosed Costello Syndrome have been observed to have unique RMD episodes affecting the tongue and other facial muscles, which is an uncommonly affected area. Muscle movements during REM sleep are often twitches and occur simultaneously with normal sleep. The position of the body during sleep may determine which motor symptom is displayed. For example, Anderson et al. Many find that their sleep is not refreshing and are tired or stressed the following day, despite getting a full nights rest. However, other patients report that their sleep patterns are infrequently interrupted due to RMD episodes and do not report being excessively sleepy during the next day as scored on the Epworth Sleepiness Scale. These aforementioned brain monitoring devices eliminate the possibility of epilepsy as a cause. RMD patients often show no abnormal activity that is directly the result of the disorder in an MRI scan. It has been noted that there is a complete absence of any EEG signs during or immediately after an intense rhythmic movement [10]. After the episode, normal EEG patterns return. Functional MRI scans have shown that the mesencephalon and pons may be involved in the loss of motor control seen during an RMD episode, which is similar to other movement disorders [11]. Episodes[edit] Episodes of RMD are short, lasting between 3 and seconds. Rare cases of constant RMD can last for hours. The majority of RMD episodes usually occur just before or during sleep. Some cases have been reported on rhythmic movements during wakeful activities like driving. In some patients who also experience sleep apnea, episodes of apnea can be followed immediately by RMD-like symptoms, suggesting that the apnea episodes may trigger an RMD episode. Similarly, current studies suggest that external stimuli are not the cause of RMD episodes. Rare cases of adult RMD have developed due to head trauma, stress, and herpes encephalitis. As familial incidence rate is still relatively low, it is believed that behavioral aspects may play a larger role in RMD than family history and genetics. Another theory suggests that RMD is a learned, self-stimulating behavior to alleviate tension and induce relaxation, similar to tic movements. It has been seen that children who have underdeveloped vestibular systems benefit from performing RMD-like movements which stimulate the vestibular system [15]. Development[edit] Sleep-related movements are commonly seen in children, especially infants. However, the majority of these movements stop as the child ages. Because of this, a thorough clinical evaluation is necessary. Often, impairments are not severe enough to warrant this process and so RMD is not often diagnosed unless there are extremely interfering or disabling symptoms. Many patients do not seek treatment for RMD directly and most seek professional help to alleviate sleep-affecting symptoms. To compound the issue, many sufferers are often misdiagnosed as having Restless Legs Syndrome or sleep apnea or some combination of the two. Rhythmic movement disorder can also have symptoms that overlap with epilepsy. However, because the disorder may affect wakeful behavior, many adults who continue to suffer from RMD may seek treatment. Benzodiazepines or tricyclic antidepressants have been considered as therapeutic options in managing the disorder. Infantile and adolescent RMD respond well to low doses of clonazepam. In such a therapy, sufferers are asked to perform RMD-like motions during the day in a slow and methodic manner. In such, patients come short of full rhythmic movements that they experience in sleep. Such behavioral training has been shown to carry over into sleep, and the forcefulness of the RMD movements is reduced or eliminated.

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2: Effects of Physical Activity and Inactivity on Muscle Fatigue

Fitness Concepts Quizzes. By measuring the most force a muscle can produce in one effort. Activities that involve continuous rhythmic movements of large.

Received Jan 20; Accepted Apr This is an open-access article distributed under the terms of the Creative Commons Attribution Non Commercial License , which permits non-commercial use, distribution, and reproduction in other forums, provided the original authors and source are credited. This article has been cited by other articles in PMC. Abstract The aim of this review was to examine the mechanisms by which physical activity and inactivity modify muscle fatigue. It is well known that acute or chronic increases in physical activity result in structural, metabolic, hormonal, neural, and molecular adaptations that increase the level of force or power that can be sustained by a muscle. The factors that determine the fatigue profile of a muscle during intense exercise include muscle fiber composition, neuromuscular characteristics, high energy metabolite stores, buffering capacity, ionic regulation, capillarization, and mitochondrial density. Muscle fiber-type transformation during exercise training is usually toward the intermediate type IIA at the expense of both type I and IIx myosin heavy-chain isoforms. Decreases of the habitual activity level due to injury or sedentary lifestyle result in partial or even compete reversal of the adaptations due to previous training, manifested by reductions in fiber cross-sectional area, decreased oxidative capacity, and capillarization. Complete immobilization due to injury results in markedly decreased force output and fatigue resistance. Muscle unloading reduces electromyographic activity and causes muscle atrophy and significant decreases in capillarization and oxidative enzymes activity. The last part of the review discusses the beneficial effects of intermittent high-intensity exercise training in patients with different health conditions to demonstrate the powerful effect of exercise on health and well being. Due to the fact that a decrease in muscle performance may ensue even during a submaximal activity, a more appropriate definition of fatigue for any population may be: Muscle fatigue is a common symptom during sport and exercise activities, but is also increasingly observed as a secondary outcome in many diseases and health conditions during performance of everyday activities Rimmer et al. In many of these health conditions, physical inactivity is a major contributing factor to the increased fatigability of the patient. Deconditioning as a result of restricted physical activity results in large decreases in muscle mass and strength, as well as increased fatigability due to changes in muscle metabolism Bloomfield, ; Rimmer et al. On the other end of the physical activity spectrum, chronic exercise training increases muscle strength and function, and enhances the ability of the muscles to resist fatigue in healthy individuals and patients of all ages Bishop et al. The aim of the present review is to investigate and explain the differences in muscle fatigue between individuals with different physical activity levels histories. The effects of different types of training will be evaluated and compared, while the factors that contribute to muscle fatigue in healthy individuals will be analyzed. Also, the outcomes of an acute or chronic decrease in physical activity due to injury, immobilization, or illness will be examined. Finally, the beneficial effects of exercise in patients with different health conditions will be presented in an attempt to demonstrate the powerful effect of exercise training not only on sport performance, but also on health and well being. Muscle Fatigue in Individuals with Different Training Backgrounds Training history has an impact on muscle fatigue profile during high-intensity exercise. It is well known that power trained athletes are stronger and faster than both endurance athletes and untrained individuals. When comparing the fatigue profiles of those athletes, a lower peak power but a slower rate of muscle power decline is observed in endurance athletes than in power athletes. This is due to the ability of endurance trained athletes to better maintain their performance during the test as shown by their lower fatigue index, calculated as the rate of drop from peak to end power output. The differences in fatigue between power and endurance trained athletes are more evident when repeated bouts of maximal exercise are performed with short recovery intervals. A common method to examine fatigue in maximal repeated muscle performance is to calculate fatigue during a protocol of short-duration sprints, interspersed with brief recoveries Bishop et al. In that case, fatigue index is expressed as the drop of peak or mean power from the first to the last sprint Hamilton et al. This was accompanied by smaller disturbances in blood homeostasis as reflected by lower post-exercise blood lactate concentration Bishop and Spencer, One important factor that may contribute to the slower rate of fatigue and the smaller metabolic disturbances of endurance trained individuals is their higher aerobic fitness. It has been shown that endurance athletes have higher oxygen uptake during a repeated sprint test, indicating a greater contribution of aerobic metabolism to energy supply Hamilton et al. The comparison of fatigue profiles between athletes with different training background reveals some possible mechanisms that determine the ability of the muscle to maintain high performance. It is now accepted that the factors causing fatigue may range from central e. High-intensity exercise, usually in the form of repeated bouts interspersed with a short interval, can be used as a model to examine muscle fatigue both in health and disease. The recent use of intense interval exercise as a time-efficient and highly effective strategy for training healthy individuals Burgomaster et al. The traditional distinction between slow and fast muscle fibers based on myosin ATPase, has been replaced by the characterization according to the expression of myosin heavy-chain MHC isoforms. The classification of fibers according to MHC can provide an informative picture about functional characteristics such as strength, power, and fatigue resistance Bottinelli, ; Malisoux et al. Based on the major MHC isoforms, three pure fiber types can be identified: Although these fiber types have similar force per unit cross-sectional area CSA , they differ considerably in maximum shortening velocity type I about four to five times slower than IIX and power generating capacity Sargeant, Furthermore, type IIX fibers have an enzymatic profile that favors anaerobic metabolism, namely, high resting phosphocreatine PCr content Casey et al. This profile makes the fiber more vulnerable to fatigue due to energy depletion or accumulation of metabolites Fitts, On the other hand, type I fibers have a higher content and activity of oxidative enzymes that favor aerobic metabolism and fatigue resistance Pette, Thus, muscles with a greater proportion of type I fibers would be more fatigue resistant compared with muscles with a greater proportion of type IIA and type IIX fibers. The greater fatigability of individuals whose muscles have a high percentage of type II fibers was demonstrated in several studies. For example, Hamada et al. Similar findings were reported by Colliander et al. An interesting finding in that investigation was that when blood flow to the leg was occluded using a pneumatic cuff, the decrease in peak force was fivefold greater in the group of subjects with higher percentage of type I muscle fibers. This indicates the reliance of these fibers on blood flow, oxygen availability, and aerobic metabolism Colliander et al. At the same time, type I fibers showed no change in ATP. This may suggest that the contribution of the faster and powerful fibers that contain the IIX isoform may be decreased after the first few seconds of high-intensity exercise Sargeant, Ionic regulation During high-intensity exercise large changes in metabolites and ions are observed within the working muscles Juel et al. Effects of reactive oxygen species on skeletal muscle mass and function There is growing evidence that reactive oxygen species ROS and reactive nitrogen species RNS are produced in skeletal muscles under physiological exercise as well as under pathological conditions Lamb and Westerblad, ; Pellegrino et al. The most important ROS are: Although increased ROS are implicated in muscle fatigue, it is becoming increasingly clear that ROS are important components in normal cellular signaling and adaptation Westerblad and Allen, From all the administered antioxidant supplements e. Also, as a thiol donor, NAC also supports resynthesis of one of the major endogenous antioxidant systems, glutathione Hernandez et al. Reactive oxygen species have also been implicated in damage of cell proteins, DNA, and lipids through oxidation and thus have been related with muscle damage and muscle wasting observed in heavy exercise, disuse, and various pathological conditions Pellegrino et al. However, the co-existence of oxidative stress and muscle atrophy does not necessarily imply a cause and effect relationship for the hindlimb unloading model. Similarly, data from the few human bed rest studies suggest a decrease in protein synthesis, suggesting anabolic resistance, and not mainly protein breakdown due to oxidative stress for a review see Pellegrino et al. However, in respiratory, kidney, and cardiac disease and muscular dystrophy the pivotal role of oxidative stress and increased proteolysis has been suggested Moylan and Reid, Contribution of oxidative metabolism to energy supply In recent years, data have been accumulated showing the significant contribution or oxidative metabolism to the energy supply during short bouts of all-out exercise, such as sprinting Bogdanis et al. An early study by Gaitanos et al. They were the first to suggest that power output during the last sprints was probably sustained by increased contribution of oxidative metabolism. The enhanced contribution of oxidative metabolism to repeated all-out exercise was quantified in a later study using a protocol of two 30 s sprints separated by 4 min of passive rest Bogdanis et al. An increased aerobic contribution to energy supply during repeated bouts of high-intensity exercise has been reported for endurance trained individuals Hamilton et al.

3: Physical Activity and Exercise

refers to the amount of force that can be exerted by a muscle or muscle group in a single effort. Muscular Strength refers to the ability of a muscle or muscle group to produce force over a period of time.

At any given velocity of movement, the amount of force produced depends on the fiber type. Under isometric conditions, during which the length of the muscle does not change while it is contracting, ST fibers produce exactly the same amount of force as FT fibers. The difference in force is only observed during dynamic contractions. At any given velocity, the force produced by the muscle increases with the percentage of FT fibers and, conversely, at any given force output, the velocity increases with the percentage of FT fibers. There is great variability in the percentage of fiber types among athletes. For example, it is well known that endurance athletes have a greater proportion of slow-twitch fibers, while sprinters and jumpers have more fast-twitch fibers Costill, et al. Differences in muscle fiber com- position among athletes have raised the question of whether muscle structure is an acquired trait or is genetically determined. During voluntary isometric and concentric contractions, the orderly pattern of recruitment is controlled by the size of the motor unit, a condition known as the size principle Henneman, et al. Small motor units, which contain slow-twitch muscle fibers, have the lowest firing threshold and are recruited first. Demands for larger forces are met by the recruitment of increasingly larger motor units. The largest motor units that contain the fast-twitch B fibers have the highest threshold and are recruited last. No matter what the workout intensity, slow-twitch motor units are recruited first. If the workout intensity is low, these motor units may be the only ones that are recruited. If the workout intensity is high, such as when lifting heavy weights or per- forming intervals on the track, slow- twitch motor units are recruited first, followed by fast-twitch A and fast- twitch B, if needed. There is some evidence to suggest that the size principle could be altered or even reversed during certain types of movements-specifically those that contain an eccentric muscle lengthening component-such that fast-twitch motor units are recruited before slow- twitch motor units Denier van der Gon, et al. It is possible that a preferential recruitment of fast-twitch motor units, if it exists, is influenced by the speed of the eccentric contraction, and can only occur using moderate to fast speeds Karp, ; Nardone, et al. DETERMINING FIBER TYPE Since the only way to directly determine the fiber-type composition in an athlete is to perform an invasive muscle biopsy test in which a needle is stuck into the muscle and a few fibers are plucked out to be examined under a microscope , some studies have tried to indirectly estimate the fiber-type composition within muscle groups of an individual by testing for a relationship between the different properties of fiber type and muscle fiber composition. This type of research has yielded promising results, with significant relationships being found between the proportion of FT fibers and muscular strength or power Coyle, et al. An indirect method that can be used in the weight room to determine the fiber composition of a muscle group is to initially establish the 1RM the greatest weight that they can lift just once of your athletes. If the athlete can do between 7 and 12 repetitions, then the muscle group probably has an equal proportion of fibers Pipes, Because lifting weights requires the use of many muscles at once, this method does not work for individual muscles, just muscle groups. In order to determine the fiber-type composition of an individual muscle, a needle biopsy of the muscle of interest must be performed. Another indirect method that the coach can use, especially when the athletes are young or new to the sport, is to have the athletes try a number of different events. Their dominant fiber type will soon become evident based on their success in certain events, and this discovery can lead to more directed future training for each athlete. For example, an athlete with a greater proportion of fast- twitch fibers will not be able to complete as many repetitions at a given relative amount of weight as will an athlete with a greater proportion of slow-twitch fibers and therefore will never attain as high a level of muscular endurance as will the ST -fibered athlete. Similarly, an athlete with a greater proportion of ST fibers will not be able to lift as heavy a weight or run intervals as fast as will an athlete with a greater proportion of FT fibers and therefore will never be as strong or powerful as will the FT - fibered athlete. It is important to remember that, even within the group of sprinters or distance runners on your team, there will still be a disparity in the fiber types. Not all the sprinters will have the same percentage of FT fibers, nor will all the distance runners have the same percentage of ST fibers. Therefore, some sprinters may be able to complete 10x meters in a workout while others are fatigued after 8 repetitions. Likewise, some distance runners may be able to complete 8x meters, while others may fatigue after 5 repetitions. Depending on each particular athlete, the coach should decide whether those who fatigue sooner because of more FT fibers should be given longer rest periods between intervals in order to complete the workout, or should run fewer repetitions at a faster speed. Training a FT -fibered muscle for endurance will not increase the number of ST fibers, nor will training a ST-fibered muscle for strength and power increase the number of FT fibers. However, there is no inter-conversion of fibers. FT fibers cannot become ST fibers, or vice versa. What an athlete is born with is what he or she must live with. Although the type of fiber cannot be changed from one to another , training can change the amount of area taken up by the fiber type in the muscle. In other words, there can be a selective hypertrophy of fibers based on the type of training. This happens because the ST fibers will atrophy get smaller while the FT fibers will hypertrophy get larger. The change in area will lead to greater strength but decreased en- durance capabilities. In addition, since the mass of FT fibers are greater than that of ST fibers, the athlete will gain mass, as measured by the circumference of the muscle. Conversely, if the athlete trains for muscular endurance, the FT fibers will atrophy while the ST fibers hypertrophy, causing a greater area of ST fibers. The decrease in mass may be observed by a smaller circumference of the muscle. Many coaches know that, for gains in muscular strength, one should train with heavy weights and few repetitions. This training regimen works because using heavy weights recruits the FT -B fibers, which are capable of producing a greater force than the ST or FT -A fibers. Training with a low or moderate intensity will not necessitate the recruitment of the FT -B muscle fibers. Therefore, the training intensity must, be high. But how heavy a weight and how many repetitions should you use? Muscular strength is primarily developed when an 8-repetition maximum 8RM, the maximum amount of weight that can be lifted eight times or less is used in a set. This latter recommendation assumes that the focus of training is hypertrophy for strength, rather than hypertrophy simply for muscle size. Remember, in order to improve muscular strength, FT -B fibers must be recruited. For maximum results, train your athletes according to their genetic predisposition. For example, an athlete with a greater proportion of slow- twitch fibers would adapt better to running more weekly mileage and a muscular endurance program, using more repetitions of a lighter weight. Likewise, an athlete with a greater proportion of fast-twitch fibers would benefit more from sprint training and a muscular strength program, using fewer repetitions of a heavier weight.

4: Muscle Fiber Types and Training

"Muscles"@en.. "Muscles"@en.. "Exercice--Aspect physiologique"@fr.. "" "Hemodynamics"@en.. "Nast". "Paul F.". "Paul F. Nast" "".

Introduction The term activity is used throughout this document when referring to both exercise and physical activity which can have different meanings. The System sets aerobic fitness guidelines from research validated activity questions. The health-related fitness components are cardiorespiratory endurance , body composition , muscular endurance, muscular strength , and flexibility. Exercise often implies that vigorous conditioning routines are needed to achieve fitnes s and health benefits. More recent public health recommendations depart from this idea and advance the notion that previously inactive sedentary adults will not follow vigorous conditioning routines, but are more apt to seek the safety of lower-intensity activity that is less structured 1. Current physical activity models advance the idea that a person does not need to exercise as strenuously for at least 20 minutes, as advocated in by the American College of Sports Medicine ACSM , to reduce the risk of chronic diseases 2,3. More recent recommendations support both moderate and vigorous-intense activity for 30 minutes daily or longer and the total amount of activity can also be accumulated with intemittent bouts for at least 10 minutes throughout each day 2 , The activity guidelines are largely based on research findings which demonstrate that regular moderate-intense exercise, which is more structured than physical activity, can protect against the development of cardiovascular disease by reducing several coronary heart disease risk factors Three important health benefits that reduce the risk of coronary heart disease include: Activity and Health There is general consensus within the public health community and among other scientists that the amount of activity should increase to improve national health. In the US only 22 percent of adults are active for health in light to moderate-intense activity i. Adults who participate daily in physical activity for as little as 30 minutes in moderate-intense activities like golf, tennis, walking, dancing, swimming, gardening, and actively playing with children can expect better health. Even intermittent activity throughout the day like walking up the stairs rather than taking the escalator or elevator, walking instead of driving short distances, doing calisthenics, or pedaling a stationary cycle while watching television can benefit health. The minimal amount of physical activity required for health benefits can be achieved by expending as little as 1, activity kilocalories Calories per week. More vigorous activity means less time and number of days weekly and the activity accumulation can be unstructured, enjoyable, and fit into personal patterns of daily living Every adult should accumulate 30 minutes or more of moderately intense physical activity on most, preferably all days of the week. The activity progression should be gradual and the accumulation can be intermittent throughout the day in relatively short bouts for as little as 10 minutes at a time. The recommendation emphasizes physical activity at a daily energy expenditure of approximately kilocalories Calories which is equivalent to walking 2 miles per day mph 5 times per week, or Calories each day based on 7 days per week. A very good web site that calculates calories burned during various activities or during the day is www. Another good site that equates calories expended to food intake is www. Since 60 percent of US adults are physically inactive, the emphasis is on progressing gradually at a moderate-intense rate for 5 or more days per week. The pattern of physical activity should be regular i. The general recommendation is for 5 or more days of the week if moderate-intense activities are chosen, and 3 or more days weekly if the selected activities are more vigorous. Since the recommendations are based on the total amount of activity accumulated weekly, a person can choose activities that are enjoyable and fit into a daily routine. Some researchers advance the notion that people can obtain health benefits by becoming more active throughout the day; while others feel it is important to exercise regularly and improve physical fitness. There may be truth in both of these positions since regular moderate-intense activity can improve health and help protect against the onset of many chronic diseases. Howley and Franks summarize some favorable changes that can occur by selecting the proper type and amount of activity The authors advance the idea that improvements in many health-related matters do not always depend on increasing cardiovascular fitness see term definitions: They then conclude that health outcomes and gains may act through some other means rather than just improving aerobic capacity. This idea advances the notion that the total amount of Calories expended, rather than higher activity intensity, is the most important consideration when planning a program for health. Yet other research findings demonstrate that more intense activity lowers the death rate mortality from all causes, and the mortality reduction could be related to improved aerobic capacity 16, Powell and Blair estimate that 35 percent of the coronary heart disease related deaths in the US could be prevented if every person was vigorously active Program Planning One important consideration in planning an exercise program is that conditioning will occur only with regular exercise. This principal is referred to as the principle of adaptation which means that only regular exercise produces physical gains. Adaptation depends on challenging the physical capability beyond a minimum threshold level. If the appropriate type and amount of activity is in excess of this threshold level, a training overload is incurred and physiological gain usually occurs. Regular overloading can lead to increased function an the training workload needs to be increased to maintain overload and progress when the fitness level improves. The progression rate at the beginning of an exercise program needs to be gradual to best ensure fitness benefits. Fitness should improve only when the appropriate amount of overload is progressively increased. This principle is referred to as the principle of progressive overload. When exercise stops the physical gains can regress to pre-training levels regression. Retrogression refers to an excessive training overload with a reduction in physiological gain. Retrogression can occur with highly intense single exercise bouts acute overload over extended time periods. Excessive overload over time is commonnly referred to as chronic overload. A final important concept in exercise planning is specificity. Activities need to be selected that target specific fitness components if physiologic outcomes are to occur. Weight training, for example, develops muscular fitness strength and muscular endurance not cardiorespiratory endurance or joint range of motion flexibility. A well-planned exercise program needs to include exercises that are specific to each physical fitness component and body part. Aerobic Conditioning Aerobic fitness is improved only when the circulatory and respiratory systems respond to the increased demand to supply oxygen and fuel to the working muscles and eliminate metabolic by-products. Regular exercise in aerobic activities like walking, jogging, swimming, and rowing increases the transport of oxygen to the muscles and oxygen utilization by the exercising muscles. The purpose of aerobic conditioning is to improve cardiorespiratory fitness. Aerobic conditioning requires a commitment to regular exercise in rhythmic activities that use the larger muscle groups like walking, cycling, and swimming. Improving cardiorespiratory fitness depends upon exercising at an intensity that significantly increases the heart rate and leaves you at least a little short of breath. The total activity time can also include shorter periods 8 to 10 minutes of more intense activities at 60 to 75 percent of aerobic capacity. The total exercise time does not need to exceed 30 minutes on most days when the work intensity is higher 1,2,4. Metabolism and Exercise Metabolism is the chemical reactions that produce energy in the body. The immediate source of energy for biological work is ATP adenosine triphosphate , a high energy chemical phosphate compound. Muscle ATP and CP stores are limited, and can be depleted in only seconds in activities like sprint running. Another anaerobic system anaerobic glycolysis can produce a limited amount of ATP. This energy producing system is primary in athletic events like to meter runs and 50 to meter swims. In these kinds of activities, muscle and blood lactate lactic acid significantly increases, and a considerable oxygen deficit is incurred. Stored muscle glycogen carbohydrate is the primary fuel for anaerobic glycolysis. It eventually becomes necessary to consume oxygen for energy production during prolonged exercise. Physical training improves the ability to provide ATP during activity metabolic fitness. The contribution of fats, carbohydrates, and protein to a lesser extent to the total energy output during exercise can vary significantly depending on the intensity effort needed to meet activity demands. The higher the relative in realtion to aerobic capacity activity intensity the more the muscles depend on stored carbohydrates as a fuel source since carbohydrates can be used both aerobically and anaerobically. The lower the relative intensity lesser effort of an activity the more the body depends on fat for energy production, since fat can only be used by using oxygen. When the intensity of exercise is too heavy, blood lactic acid increases. It is at this point that the anaerobic or lactate threshold is reached and the rate and depth of breathing significantly increases. Fatigue and reduced energy output occur when exercising muscle glycogen is depleted. Exercise Readiness A pre-exercise readiness questionnaire has been developed in this document for individuals who are planning to maintain or increase their activity level. It is recognized that no single set of questions can cover all situations, and specific program practices can vary. The questionnaire is for guiding individuals who should have a medical examination and exercise test before participating in a moderate or vigorous exercise program. Individuals with known or suspected cardiovascular, pulmonary, metabolic, orthopedic, or neurological disorders should consult with a physician before increasing the level of activity In the National Institutes of Health Consensus Statement on Physical Activity and Cardiovascular Health it was stated that "most adults do not need medical consultation or pretesting before starting a moderate-intensity physical activity program. However, those with known cardiovasular disease and men over age 40 and women over 50 with multiple cardiovascular disease risk factors who contemplate a program of vigorous activity should have a medical evaluation prior to initiating such a program" In the ACSM recommended a medical exam within the past year for all exercising adults The ACSM also recommended a pre-exercise medical exam including an exercise test for patients with diagnosed cardiac, pulmonary or metabolic disease, and for individuals with symptoms of cardiac or pulmonary disease. An exercise stress test was recommended for men over age 40 and women over 50 before participating in vigorous exercise greater than 60 percent of aerobic capacity. Adults are considered to be at moderate exercise risk when there are two or more CAD risk factors. ACSM guidance also includes the type and amount of activity and and the perception of effort during exercise. Otherwise, exercising between METs equivalent to brisk walking at mph may be appropriate for most healthy adults unless a person has limited exercise tolerance i. Then select Recommendations for Cardiovascular Screening--Tables. The questionnaire is not intended to render medical advice or prescribe medical treatment for specific conditions for individuals nor substitute for such advice for treatment. Always ask your physician for advice if you have questions and concerns about your physical activity readiness. By responding to the questions below, you can get a general idea as to whether exercise could be harmful to you. Diagnosed cardiopulmonary and metabolic diseases: Have you ever been told by a physician that you have a heart problem and recommended only medically supervised physical activity? Do you have cardiac, peripheral vascular, or cerebrovascular disease? Do you have chronic obstructive pulmonary disease, asthma, cystic fibrosis, or other diagnosed lung disease? Do you have kidney, liver, or thyroid disease? Do you have diabetes mellitus either type 1 or 2? Signs or symptoms suggestive of cardiopulmonary Disease: Do you experience pain, tightness or pressure in the chest, neck, jaw, arms, or other areas that may be due to insufficient blood flow? Are you short of breath at rest or with mild exertion? Have you had problems with dizziness or fainting? When you stand up or during the night, do you have difficulty breathing? Do you have an abnormally fast heart beat or fluttering? Do you experience severe pain in the leg muscles while walking?

5: CHAPTER 9: CLINICAL DISORDERS AND THE MOTOR SYSTEM

Increasing muscle mass or muscle hypertrophy occurs with an increase in size and number of the small muscle fibers, or myofibrils, within the muscles. Furthermore, bodybuilders tend to have a large amount of collagen and other noncontractile connective tissue contributing to muscle size, reports the National Strength and Conditioning Association.

Research and Rants on Performance Contributing to the betterment of performance Through questioning, providing information, scientific research, knowledge, and by reviewing beneficial topics vs. They also ask "experts" to make videos on topics that people have "googled. This is why I do not recommend the company as well as other professionals i know. Introduction Many muscle groups are involved in the sport of gymnastics. When specifically rhythmic gymnastics. At times a gymnast may manipulate one or two pieces of apparatus, including rope, clubs, hoop, ball or ribbon, or perform "free" or with no apparatus in a floor routine. The participant who earns the most points, determined by a panel of judges, for leaping, balance, pirouettes, flexibility, apparatus handling, execution and artistic effect is the winner. There are many muscle involved in this sport; large muscle groups and small muscles required for manipulative skills are involved in every aspect of this activity. Neuromuscular Control in the Rhythmic Gymnast Leaping involves many large joints in the body. The neuromuscular system must coordinate movements, and very fine control is required. Perfection in practice is essential for a translation into perfect performance, as the body will develop neurological pathways to control muscle with continual practice. Improper practice will translate into improper muscle recruitment. Performance will mimic practice. It is difficult to correct improper form after neurological pathways are developed. Knowledge of what muscle groups should be recruited is essential for success in rhythmic gymnastics. Train Specifically to Improve Perfomance Several muscles are used in rhythmic gymnastics. The sport requires fine control during manipulative skills, and a large range of motion at several joints in the body. The most important focus for the gymnast when examining which muscles to focus on is to train specifically for each event. Using principal of specificity in training, the neuromuscular system is vital to success. Train the muscles used in the correct way, using correct form, and the gymnast will be successful. Trunk Movements and Muscles Many parts of rhythmic gymnastics require a combination of joint movements and muscle contraction. Hyperextension of the trunk, using the erector spinae, or back muscles, is common. Flexion in the trunk will incorporate the rectus abdominus, or ab muscles. Lateral flexion and reduction are performed as the gymnast moves the spine laterally. The external and internal obliques are used in these movements. Increases in trunk strength will help increase core stability, which translates into improved performance. Upper Body Movements and Muscles Manipulative skills involve fine motor control and proprioreceptive feedback from the upper body. The fingers will move to manipulate the particular apparatus used by the gymnast at certain times. Intrinsic, small hand muscles play a large role in manipulating objects in rhythmic gymnastics. Larger muscles that control the wrist and fingers, such as the extensor capri radialis located in the forearm, will play a role in wrist and hand movements. The elbow will flex and extend, using biceps brachii, brachialis, and brachioradialis for flexion, and triceps brachii for extension. The shoulder movement will incorportate the deltoid, the lats or latissimus dorsi, as well as several smaller rotator cuff muscles. The shoulder girdle provides a base of support for shoulder movements, so muscles on your back, such as rhomboids and the trapezius, will be used. To improve the fine control needed in this sport, specific training and emphasizing correct form during practice are essential. Lower Body Movements and Muscles Hyperextension of the hip is imporant to increase range of motion in leaps. As the gymnast moves laterally, hip abduction and adduction are performed. The hip abductors and adductors, such as tensor fascia latae, gluteus medius, gracilis, adductor longus, adductor brevis, and adductor magnus, perform these actions. Hip flexion and extension, as well as knee flexion and extension, and ankle dorsal and plantar flexion occur as the gymnast leaps. Dorsal flexion requires contraction of the tibialis posterior, located on the front of the shin, while plantar flexion will use agonist muscle gastrocnemius and soleus, the calf muscles. Hip flexors used are psoas major and minor, iliacus, and pectineus, which are located in front of the hip and on the front of the leg. In the back of the leg are the hip extensors, which extend the leg back during a leap. These include gluteus maximus, semitendinosous, semimembranosous and biceps femoris. Several large and small muscles are involved in the lower body. Training these muscles to have the correct form, through specifically practicing as you want to perform, will help optimize performance.

6: Research and Rants on Performance: Livestrong article- Muscles Used Heavily in Gymnastics

4 Characteristics of Cardiovascular Activity 1. Large Muscle Groups - the larger the muscle mass involved, the better the activity. 2. Rhythmic - you can regulate the pacing of the activity (slow down or speed up) and still.

Work can be thought of simply as activity - either mental or physical. You carry out mental work whenever you use your brain to do something - reading, watching television, solving a problem, etc. You carry out physical work whenever you use your body to do something - walking, sitting, lifting, etc. Your body still works when you are asleep to digest food, repair tissues, keep you breathing, etc. Here, we will be concentrating mainly on physical work. Types of physical work Physical work is carried out by your muscles and is therefore often called muscular work. There are 2 types: A muscle which is heavily contracted squeezes against the blood vessels next to it, restricting blood flow. This cuts down the delivery of oxygen to the muscle and the removal of a waste product, lactic acid, from the muscle. This results in muscular aches or pain. Any fixed posture will bring on these symptoms, for example, standing to attention or sitting upright. Dynamic work is less tiring and more efficient than static work. This is because during dynamic work a muscle contracts and relaxes rhythmically which makes it act like a pump for the flow of blood in the blood vessels, allowing the blood to supply more oxygen and take away more lactic acid than during static work. Hold a small book in each hand. Put one arm straight out in front of you and keep it in that position. This arm is doing static work. With your other arm, keep your elbow at your side and move your forearm up and down repeatedly. This arm is doing dynamic work. Which arm gets tired first? Types of muscle There are three types of muscle tissue in your body: Skeletal muscle is made up of bundles of muscle fibres which can contract together in one direction. During movement, when a muscle contracts, the muscle fibres reduce in length so the amount of movement that the muscle can produce depends on the original length of these fibres. The strength of the muscle will depend on the number of fibres that it contains and the cross-sectional area of the muscle. Muscular endurance and strength Muscular endurance is the ability of a muscle or a muscle group to remain contracted over a period of time. Endurance can be static or dynamic. Static endurance can be determined by the length of time a limb can maintain a certain position, whereas dynamic endurance can be measured by the number of times a limb can perform a movement against a certain resistance. Muscular strength is the maximum amount of force that a muscle can exert under maximum contraction. The amount of force that can be exerted by your limbs depends on body posture and the direction of force. For example, when standing, you can exert more force when pulling backwards than when pushing forwards. There are several factors that influence your muscle strength and endurance: This is because men have greater muscle mass as a percentage of body mass compared to women. Clothing and any equipment you carry will add to your overall weight and therefore you will need extra muscular energy to move. Motivation and emotional state: Nature of your job: Footrests increase pulling strength by allowing you to brace your legs. The amount of force that can be exerted by your limbs depends on your body posture and the direction of force that you apply. Maximum pulling forces as percentage of body weight as percentage of body weight Physical changes during muscular work When you use your muscles and become active, several physical changes occur in your body, some of which will be very obvious to you: You need and use more oxygen Your breathing rate and depth increases Your heart rate and blood flow increases You sweat more The chemical make up of your blood and urine changes Oxygen supply and consumption Muscular work involves the contraction of muscles, a process which requires energy. This energy is obtained through the breakdown of energy-rich glucose or fat. When you are not being very active, oxygen is readily available and enough is supplied to the muscles to allow them to completely break down glucose and fat into energy, water and carbon dioxide. This process is called aerobic respiration. Lactic acid is a by-product of this anaerobic respiration process and builds up in your muscles which you feel as an ache or pain in your muscles. When you rest again and you supply enough oxygen to your muscles, this lactic acid is converted into glycogen and the muscle ache disappears. For light work, you need from 0. At this stage work is being done aerobically. A steady state of oxygen consumption is reached and maintained throughout the period of muscular work. However, during industrial or recreational activities, a steady rate of work is seldom maintained for a prolonged period so the steady state is rarely attained. During heavy work, the oxygen supply increases but soon becomes inadequate and the aerobic processes are replaced by anaerobic. This must then be paid off at the end of the work period. The harder you work and therefore the greater the anaerobic contribution, the longer it takes you to recover. Heart rate During increased activity the volume of blood flowing into the heart increases as the working muscles help to pump the blood back to the heart. This stretches the heart muscle which then contracts more forcefully, so more blood is expelled with each beat called the stroke volume. The nervous system also increases the number of heart beats per minute the heart rate. Both of these together result in much more blood being pumped by the heart. During hard work your heart rate increases up to about three times its resting value for example from 60 beats to beats per minute. When the activity stops, your heart rate returns to resting levels. The speed with which the rate falls back to resting levels depends on your fitness; the fitter you are, the faster your recovery. Your level of fitness affects your physical state during work and your recovery in several ways:

7: ergonomics4schools

Onsets of each muscle activity, integrated electromyography (EMG) and center of pressure (COP) displacement prior to the onset of Gas were compared between the single and repetitive tasks.

A ton of factors influence strength beyond muscle size and skill with the movements used to test strength. The strength of individual muscle fibers, normalized muscle force, muscle moment arms, and body proportions can all have significant, independent effects on strength. Training style has a big impact on the ratio of strength you gain relative to size, with heavier training generally producing larger gains in strength. At first, this may seem confusing. How can a guy who only weighs lbs deadlift lbs, when there are plenty of much larger men who would be thrilled to just crack the or lb barrier? Or how can a guy who weighs lbs bench press lbs, when plenty of people with more upper body musculature are still struggling to crack lbs, or even bench lbs for the first time? Oct 10, at However, we can get ourselves in the right ballpark. The average male weighs around 80kg. Maybe they add kg in the first year, kg for a couple of years, and then scrap away for marginal gains for the rest of the decade â€" a pretty typical time course for muscle growth. Generally, the relative increase in strength will be a bit smaller for isolation lifts, and a bit bigger for more technical compound lifts. Maybe they could strict dumbbell curl kg their first day in the gym, and they can eventually curl kg. Or maybe they could squat 50kg their first day in the gym, and they can eventually squat kg. In other words, they gained x more strength than muscle. In this article, I want to dig into two initially confusing observations and one general question: Some people gain proportionately more strength in response to training, while others gain proportionately more muscle, even on identical training programs. What explains the divergence? On the individual level, you gain way more strength than muscle mass across a training career because strength generally increases faster than muscle mass. If muscles are what produce the force necessary to lift heavy stuff, why would strength gains outstrip gains in muscle mass 4- to 8-fold? What is the overall relationship between gains in muscle mass and gains in strength? Strap in and buckle up, folks. This is going to be a pretty dense read. Bigger muscle fibers tend to be stronger muscle fibers. We know that specific tension force production per unit of cross-sectional area can vary dramatically between muscle fibers. In this study , there was a 3-fold difference in specific tension between the fibers with the most and least relative strength. This means that specific tension tends to decrease as fiber size increases, since cross-sectional area which is proportional to the square of the diameter increases faster than diameter. The results of this study were similar: These two studies one , two , on the other hand, showed an increase in muscle fiber specific tension in the absence of muscle growth. We also know that muscle fiber specific tension can vary up to 3-fold between muscle fibers within individuals. It may just be that having muscle fibers with higher specific tension predisposes you for success in power sports, and that having muscle fibers with lower specific tension predisposes you for success in bodybuilding perhaps having muscle fibers that are relatively weaker allows you to tolerate higher training volumes with lower injury risk because each contraction is relatively less forceful. Whole Muscles and Single Joints There are three primary factors that determine how much torque a muscle can produce at a joint: The maximum contractile force that a muscle can exert on a bone. Maximal contractile force depends on the size of the muscle itself, potentially its muscle architecture, and the amount of force it can produce per unit of size. Whether the nervous system can adequately activate all or most of the motor units in the muscle, and suppress activation of antagonistic muscles. The attachment points of the muscles. Attachment Points When muscles contract, they pull against bones, creating moments or torque, if you prefer at the joints they cross. If you compare two people whose muscles contract with the exact same amount of force, the person with the longer muscle moment arm will be able to produce a larger maximal joint moment. For example, in this study , the average muscle moment arm for the quads was With a muscle moment arm of If, on the other hand, their muscle moment arm was only Grab at point B if you want to actually get the job done. B is like a long muscle moment arm, and A is like a short muscle moment arm. Furthermore, Delp demonstrated that variation in hip joint placement could have a pretty big impact on muscle moment arms for hip flexors, extensors, adductors, and abductors as well. Furthermore, as muscles grow, their muscle moment arms tend to get longer in the process at most joints and joint angles but not all. A recent modeling study by Andrew Vigotsky demonstrates this beautifully. From Vigotsky, The variability in muscle moment arms helps explain our first conundrum a smaller guy out-lifting a larger guy , while the lengthening of muscle moment arms with hypertrophy helps explain our second conundrum gaining disproportionately more strength than muscle mass across a training career. Muscle Activation A lot of people have the notion that, under normal conditions, you can only access a portion of your strength, and that when the situation calls for it i. It very well may be true that motor unit recruitment increases with training experience in compound lifts. Maximum Contractile Force â€" Dependent on Size and Architecture The rest of the variability not explained by variations in muscle moment arms and slight variation in muscle activation must be explained by the intrinsic ability of a muscle to produce force. The rest, then, depends on factors that affect muscle strength independent of muscle size. NMF is very similar to specific tension. Most but not all studies show that NMF increases in response to training. Therefore, something is allowing the muscle to produce more force without an increase in the force-producing capability of the individual muscle fibers, and generally without an increase in muscle activation. The most likely explanation for the discord between muscle fiber specific tension and NMF is an increase in connective tissue and membrane proteins, allowing for lateral force transmission from a muscle fiber to surrounding connective tissue. This force can then be transferred to the tendons , adding to the force delivered to the tendon directly from each muscle fiber at the musculotendinous junction. We can see this effect in action in studies that report both fiber specific tension and NMF both of which are force output divided by cross-sectional area. The muscle can produce more force per unit of size than the individual muscle fibers can, because that force can be more efficiently transmitted to the tendons via connective tissue attachments. However, a study by Erskine lends support to this position. Enhanced lateral force transmission via increased connective tissue offshoots would allow for more efficient force transmission between the muscle fibers and the tendons, but it would also decrease the effective length of the muscle fibers. In this study, no performance metrics changed at the muscle fiber level: All of those findings are consistent with the lateral force transmission hypothesis: It will take direct studies of those connective tissue offshoots and changes in membrane proteins like dystrophin to confirm the hypothesis, but at the moment, it seems to be the most likely explanation for the increase in NMF in response to training. Furthermore, post-training NMF was The little guy may outlift the bigger guy because of more favorable muscular attachment points longer muscle moment arms , more beneficial muscle architecture, or higher NMF. The net summed knee and hip extension moment required to lift a weight can be approximated with this equation: In other words, at a given depth and with a given load, the total lower-body demands in the squat are determined by the length of your femur. We can get an idea of the magnitude of its effect by looking at the research on training specificity. In short, strength gains are specific to the muscle action concentric vs. Muscle architecture changes may play a role in some of those dimensions muscle action and range of motion especially , but most of the differences can likely be attributed to your nervous system learning how to optimally produce force based on the specific demands of a movement. This study by Mitchell is often held up as a prime example illustrating the principle of specificity. The impact of skill learning would likely be much larger in a more complex movement like a squat, bench press, deadlift, clean and jerk, snatch, etc. Skill acquisition can help shed some light on both of our conundrums. If gaining skill can help you lift more weight, that helps explain why you have the capability to gain more strength than muscle mass across a training career. This is what you typically see in motor learning studies. Degree of error decreases pretty quickly with practice, then starts leveling off. However, some people with lots of practice still make more errors and larger errors that some people with minimal practice. Motor skills are trainable, but trainability is likely at least partially innate. Image from Tanaka, The Relationship Between Gains in Strength and Gains in Size At this point, it should be clear that there is a multitude of factors that influence strength apart from sheer muscle size. Muscle cross-sectional area generally explains around half the variability you see in strength, but plenty of other factors can play a role, from muscle fiber specific tension to muscle moment arms to muscle architecture to NMF to skill learning. Since NMF improves with training, muscle moment arms tend to get longer with training, and skill acquisition can play a major role in strength development especially for more complex movements, though skill learning can impact something as simple as unilateral knee extensions , gaining more strength than muscle mass over a training career should make a lot more sense. Plus, muscle moment arms vary person to person and can affect strength output independent of muscle contractile force. Therefore, it should be clear why some people with less muscle can outlift people with more muscle. The first, a recent study by Ahtiainen , found that there was essentially no correlation whatsoever between gains in quadriceps size and gains in leg press strength after a month training period in a heterogeneous, untrained population males and females, aged years old. Another 9-week study by Erskine used a homogeneous, untrained population year old males and found that the relationship between gains in muscle and gains in strength depended on how strength and muscle mass were measured. Muscle volume is exactly what is sounds like â€" the volume of the muscle. Gains in muscle volume during the week training period correlated with gains in strength: Thus far, there are only two studies on trained lifters. As you can see, the relationship is much stronger for the squat than for the bench press. Perhaps the strong relationship between changes in LMI and changes in squat 1rm versus the lack of relationship between changes LMI and changes in bench press strength should be expected, since the squat tests the strength of a much larger proportion of your muscle mass. However, this finding contrasts somewhat with Baker, who found that changes in LBM predicted gains in bench press strength somewhat more than changes in squat strength. Taken together, a clear trend emerges from these studies: In untrained populations, the relationship between gains in muscle and gains in strength is very weak and tenuous, but as training status increases, the relationship strengthens. As you can see, in studies with more experienced participants, the relationship between muscle gains and strength gains tends to be stronger. So the next logical question becomes: As a matter of fact, yes. Especially early in a training program, gains in strength far outstrip gains in muscle mass. In fact, many studies show little to no increases in muscle mass within the first weeks of training and studies that do show earlier hypertrophy may be confounded by swelling and inflammation in the muscle , whereas strength gains start from day 1. The two most likely explanations are early gains in motor skill which accrue very rapidly within the first few training session and early changes in NMF.

8: Rhythmic movement disorder - Wikipedia

One important question about adenosine, especially when comparing small and large muscle mass exercise, is the relatively high levels of saturation seen in the venous effluent during small muscle mass exercise.

9: Size vs. Strength: How Important is Muscle Growth For Strength Gains? â€¢ Stronger by Science

Deconditioning as a result of restricted physical activity results in large decreases in muscle mass and strength, as well as increased fatigability due to changes in muscle metabolism (Bloomfield, ; Rimmer et al.,).

LARGE VS. SMALL MUSCLE MASS ACTIVITY IN RHYTHMIC EFFORT pdf

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