

Training Programs (Weight training, Plyometric and Flexibility)

Ph.D. Course Work (Physical Education)

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MUSCULAR CONTRACTION AND ITS TYPES

Muscular Contraction - A change in size, shape, pressure according to principle of neuro-muscular physiology is called muscular contraction.

Types of muscular contractions

- 1. Static/ Isometric - Constant Length** - In this contraction tension is developed within the muscle against resistance but there is no change in the length of muscle because the external resistance is much more higher than the maximum tension produce by the muscle.
- 2. Dynamic/Isotonic/Auxotonic** – Constant Tension - In this contraction muscle shortens or lengthens with varying tension while lifting a constant load. During dynamic contraction when the length of muscle decrease it is called **CONCENTRIC CONTRACTION** & when length increases it is called **ECCENTRIC CONTRACTION**.
 - Muscle shortens/ lengthens is affected by 3 factors
 - 1) Initial length of muscle fibers**
 - 2) Angle of pull of the muscle**
 - 3) Speed of contraction**

CONTD.

1. Isokinetic – Constant Speed –

- ❑ In this contraction maximum tension is developed in the muscle which shortens at constant speed at all angles over the full range of motion.
- ❑ Isokinetic exercises performed in Isokinetic machines which have a speed governor so that speed of movement is constant & the muscle generates maximum tension throughout the entire range of motion.
- ❑ This special feature of Isokinetic machine is called ACCOMODATING RESISTANCE. Example – Libido, Kincom, Cybex, Biodex etc.

1. Combination Of Dynamic And Static –

- ❑ Some sports like gymnastics we can see that this type of contraction
- ❑ for example in assuming L position on roman rings abdominal muscles first contract concentrically to bring the legs in proper position then the position is maintained for required duration by the static contraction of abdominal muscle.
- ❑ The gradual lowering of the legs from the position is made possible by the eccentric contraction of abdominal muscle.

WEIGHT TRAINING

- Key to the development of **muscular strength** is the **progressive resistance training**, which can be best, achieved through selected weight training exercises.
- **group of exercises** : A group of 6 to 8 exercises with varying sets and repetitions involving different parts of the body is usually included in a programme of weight training.
- **Repetition** - repetition refers to the number of times a resistance is over-come
- **set** - set is the period during which the required number of repetitions are to be performed without the weight beings put down.

Modes of Strength Training

Two basic types of training methods are used to improve strength: isometric and isotonic.

- **Isometric or static training** refers to a muscular contraction producing little or no movement, such as pushing or pulling against immovable objects.
- **Isotonic or dynamic training** refers to a muscular contraction with movement, such as lifting an object over the head]

Isotonic training programs can be conducted

- without weights
- with free weights (barbells and dumbbells),
- fixed resistance machines,
- variable resistance machines,
- and isokinetic equipment

ISOKINETIC MACHINES

- :As the popularity of strength training increased, new strength-training machines were developed. This new technology brought about the introduction of isokinetic and variable resistance training.
- These training programmes require the use of special machines equipped with electronic/mechanical devices that provide a variable resistance, with the intent of overloading the muscle group maximally through the entire range of motion.
- A distinction of isokinetic training is that the speed of the muscular contraction is kept constant because the machine provides an accommodating resistance to match the user's force through the range of motion

Isokinetic Loading

100%

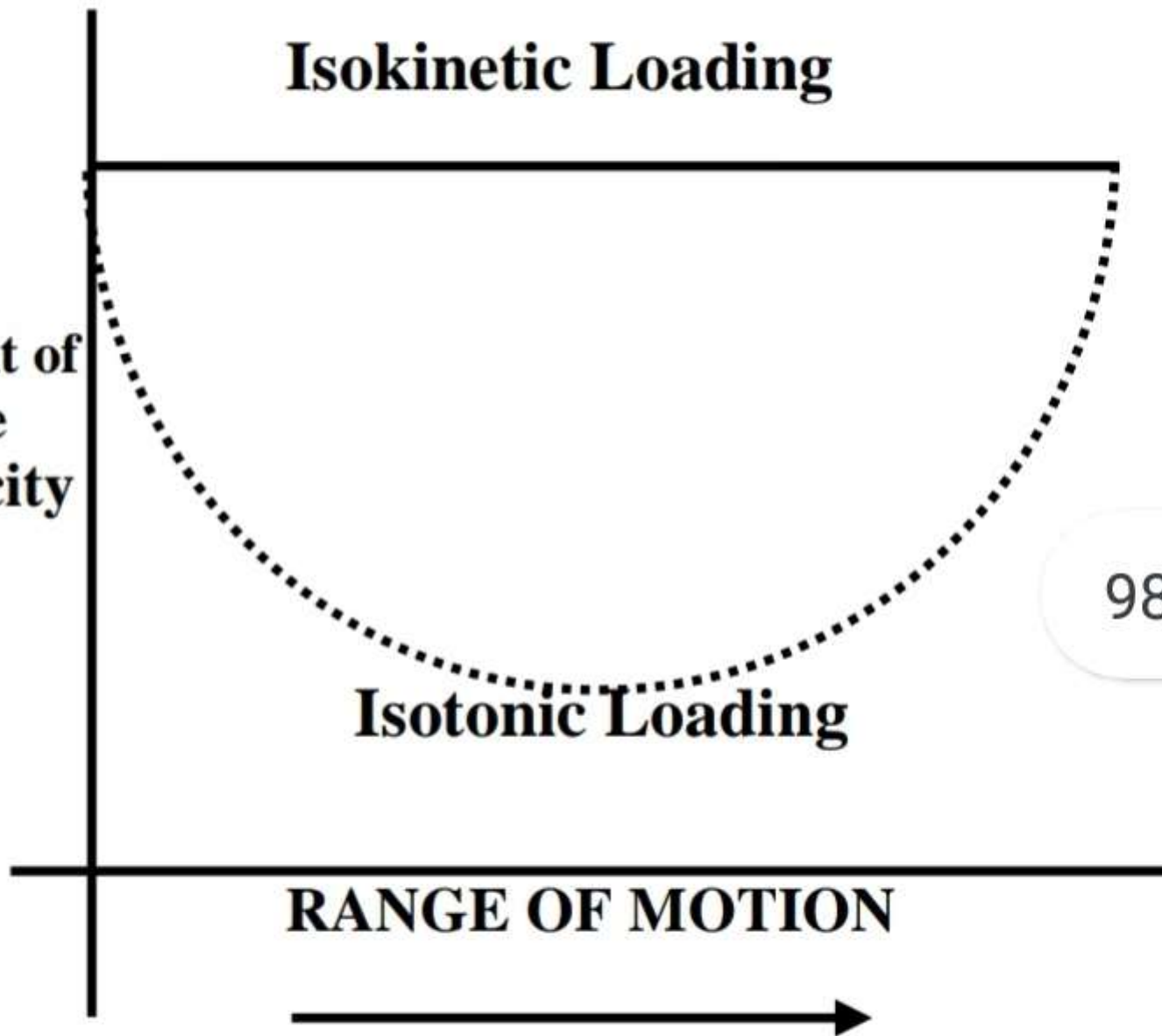
Percent of
Muscle
Capacity

0%

Isotonic Loading

RANGE OF MOTION

98/247



<ol style="list-style-type: none"> 1. Isometric exercises involve static muscle contraction against a stationary resistance. 2. It is used only in a few games like Gymnastics, weightlifting, wrestling, etc. 3. It develops maximum strength. 4. Iso-'same', metric-length; this is a type of muscle contraction in which muscle remains at same length. 5. Can rehabilitate immobilised joint. 6. Amount of strength developed does not last long. 7. Poor development of coordination and skill. 8. Does not contribute to development of endurance and speed. 9. Examples are: (a) Pushing against a wall (b) Flexed arm hang, etc. 	<ol style="list-style-type: none"> 1. Isotonic exercise involves dynamic movement but does n't require a constant movement speed. 2. Isotonic exercises are most popular and effective type of strength training used in almost all games/sports. 3. It develops explosive strength. 4. Iso-same, tonic-tension. A type of muscle contraction in which the muscle changes the length either shortening or lengthening. 5. Does not contribute to rehabilitation. 6. Strength developed through this method remains for longer period. 7. Develops excellent coordination. 8. Contributes to development of strength, endurance and speed. 9. Examples are : (a) Push ups, pull ups. (b) Rope climbing, bench press, over head press, etc. 	<ol style="list-style-type: none"> 1. This involves movement but maintains a constant speed. 2. Isokinetic generally involves muscle contraction against an electronic resistance and is specific to a particular sport. 3. It develops explosive strength as well as strength endurance. 4. Iso-same, kinetic-speed. Isokinetic exercises are done with machine that regulates, movement, velocity and resistance. 5. Cannot rehabilitate immobilized joint. 6. Amount of strength developed is excellent. 7. Develops good coordination. 8. Better development of speed as compared to Isotonic. 9. Examples are : (a) Treadmill (b) Cybex (c) Butterfly stroke in swimming, etc.
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	Load			Load			Unload			Load		
Lifting Warm-up												
BB Rack Shrug OR Rack Jump OR Rack Clean	2x5			3x5			3x5			3x5		
BB High Pull	2x5			3x5			3x5			3x5		
BB Standing Shoulder Press OR DB Shoulder Raises	2x5			3x5			3x5			3x5		
Pulling Choice	2x10			3x10			3x10			3x10		
Bicep Choice	2x10			3x10			3x10			3x10		
Ab Planks	2x 15-30 seconds			3x 15-30 seconds			3x 30-45 seconds			3x 30-45 seconds		
Tuesday - Strength	Week 1 - 60%			Week 2 - 65%			Week 3 - 60%			Week 4 - 70%		
Lifting Warm-up												
BB Front Squat OR Modified Squat	2x10			3x10			3x10			3x10		
BB Romanian Deadlift (RDL)	2x10			3x10			3x10			3x10		
Single Leg Choice	2x10ea			3x10ea			3x10ea			3x10ea		
BB Incline Bench Press	2x10			3x10			3x10			3x10		
Triceps Choice	2x10			3x10			3x10			3x10		
AB Choice	2x10			3x10			3x10			3x10		
Thursday - Explosive	Week 1 - 60%			Week 2 - 65%			Week 3 - 60%			Week 4 - 70%		
Lifting Warm-up												
BB Rack Shrug OR Rack Jump OR Rack Clean	2x5			3x5			3x5			3x5		
BB High Pull	2x5			3x5			3x5			3x5		
BB Standing Shoulder Press OR DB Shoulder Raises	2x5			3x5			3x5			3x5		
Pulling Choice	2x10			3x10			3x10			3x10		
Bicep Choice	2x10			3x10			3x10			3x10		
Ab Planks	2x 15-30 seconds			3x 15-30 seconds			3x 30-45 seconds			3x 30-45 seconds		
Friday - Strength	Week 1 - 65%			Week 2 - 70%			Week 3 - 65%			Week 4 - 75%		
Lifting Warm-up												
BB Back Squat OR Modified Squat	2x10			3x10			3x10			3x10		
BB Romanian Deadlift (RDL)	2x10			3x10			3x10			3x10		
Single Leg Choice	2x10ea			3x10ea			3x10ea			3x10ea		
BB Bench Press	2x10			3x10			3x10			3x10		

Plyometric

training methods which would enable them a sports person to-

- to run faster,
 - jump higher, and
 - throw an object farther.
- ❑ To achieve such goals, power is essential. Strength gains can be transformed into power only by applying specific power training. Perhaps one of the most successful methods is training that employs **plyometric exercises**

TERMINOLOGY

The term plyometrics has been derived from the

- Greek word pleythyein, meaning, “to increase” and
- the shorter Greek words plio “more” and
- plyo “to move”. Metrics means “length”.

1.

- ❑ Plyometrics is known as the **stretching shortening cycle, or myotatic stretch reflex**, in which the muscle is loaded in an eccentric (lengthening) contraction, followed immediately by a concentric (shortening) contraction.
- ❑ Research has demonstrated that a muscle stretched before a contraction will contract more forcefully and rapidly (Bosco & Komi, 1980; Schmidtbleicher, 1984).
- ❑ For example, by lowering the center of gravity to perform a takeoff, the athlete stretches the muscle, resulting in more forceful contraction.

Plyometric action

- ❖ Plyometric action relies on the stretch reflex found in the belly of the individual muscle.
- ❖ The main purpose of the stretch reflex is to monitor the degree of muscle stretch and prevent overstretching.
- ❖ When an athlete jumps, a great amount of force is required to propel the body upward. The body must be able to flex and extend quickly to leave the ground.
- ❖ A plyometric exercise relies on this quick body action to attain the power required for the movement

The following exercises are done for developing explosive strength of lower and upper extremities:

Hopping

- The primary emphasis in hopping is to achieve height or distance with a maximum rate of cyclic leg movement.
- The height of the hop is gradually increased.
- In each set 15 to 25 repetitions are performed.
- Between sets full recovery is provided. In all 3 sets are recommended.

Bounding

- The emphasis in bounding is to gain maximum horizontal distance, with height being a factor in the success of that distance. It is described as taking off from one leg and landing on the other.
- This exercise involves alternate hopping stepping. 3 to 5 sets each of about 20 repetitions are performed.
- Between sets full recovery is provided.
- Standing hops and jumps, with different combinations of hops and jumps can be performed.

Depth Jumps.

- This method involves jumping down from a height of 40 to 120 centimeters and then jump forward for distance or jump up for height.
- 3 to 5 sets, each of 10 repetitions, are done.
- Full recovery between two sets is provided.

Medicine ball exercises

- A variety of medicine ball exercises can be performed especially for improving the explosive strength of the upper extremity.

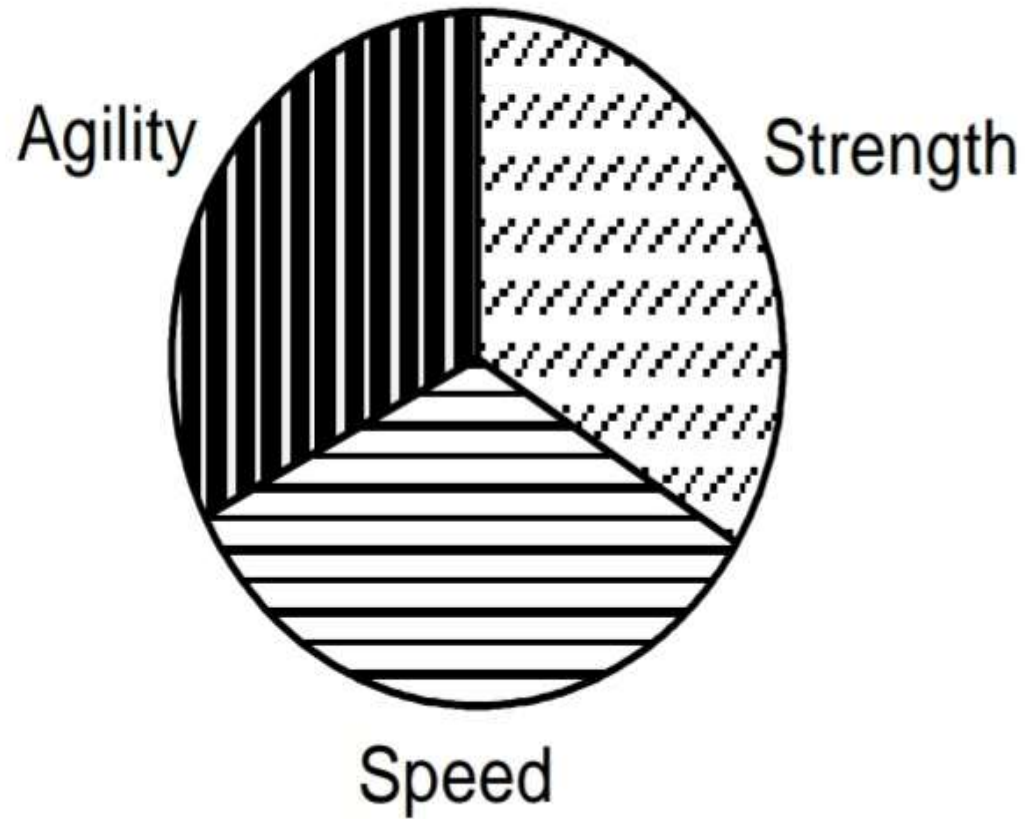
Some of the popular exercises are:

- i) Medicine ball over and under
- ii) Medicine ball half and full twist
- iii) Medicine ball scoop toss and throw
- iv)) Medicine ball chest pass
- v) Supine two-arm overhead throw
- vi) Kneeling two-arm overhead throw
- vii) Standing two-arm overhead throw
- viii) Sit-up throw
- ix) Stepping two-arm overhead throw
- x) Chest push from kneeling position

Plyometric program

PLYOMETRIC TRAINING

WEEK	Weeks 1-3	Weeks 3-6	Weeks 6-8
SET AND REPETITIONS	1-2 Sets/ 10 Repetitions	1-2 Sets/ 08 Repetitions	1-2 Sets/ 08 Repetitions
PLYOMETRIC EXERCISES	1. Clapping push ups	1. Shock push ups	1. Decline push ups
	2. Tuck jump	2. Ankle jump	2. Depth jump leap
	3. Alternate leg diagonal	3. bound Lateral cone hops	3. Standing broad jumps
	4. Double leg jump	4. forward Double leg butt	4. kick Fast skipping
	5. Arrow cone drill	5. T-drill	5. X-drill
	6. Squat jump	6. Split jump	6. Split
	7. Vertical jump	7. Long-jump & sprint	7. Jump & turn 90°
	8. Box skip	8. Front box jump	8. Box jump



Flexibility

- ❑ Flexibility, often also referred to as joint mobility or suppleness, can be defined as the ability to perform movement with greater range of motion or large amplitude.
- ❑ It is controlled partly by the energy liberation processes of the body and partly by the coordinative processes of central nervous system

The type of flexibility required varies considerably from sport to sport. For example, the hurdler requires the best possible hip flexor movement, and the swimmer ankle flexibility. Others such as gymnastics, multi-event athletics and the martial arts, require a high level of flexibility in many joints. Several sports require static or extent flexibility. However, the majority of major sports require dynamic flexibility, where the joint is forced to work at a very high speed.

Methods of Flexibility

Ballistic Method

- Movement is done with a swing in a rhythmic manner to its maximum range. Good warming up is an important pre-requisite failing, which injuries can result.
- In this method, since agonist muscle performs the movement and the antagonist helping in returning the moved joint to the starting position, it helps in improving neuro-muscular co-ordination.

Limitation of method

- This procedure has certain shortcomings i.e. swing movement results in stretch reflex of the antagonist muscle thus creating a hindrance in performing movement over greater range.
- In spite of this limitation, the method is still in use because it is more closely related to nature of sports movement and helps in the development of skill.

Flexibility training Method

Slow Stretching Method

- This method is better than ballistic method because it results in better improvement of flexibility and also minimizes chances of injury.
- In this procedure, the muscle is stretched slowly to its maximum limit and then slowly brought back to its original position.
- Because of slow and gradual stretching, the stretch reflex action is avoided.

Slow Stretching and Holding Method

- This method is superior to the previous two training means.
- In this method, the muscle is stretched slowly to its maximum limit and is held there for about 6 to 10 seconds.
- The muscle is then slowly brought back to its normal position.
- In view of slow stretching, this method prevents stretch reflex and minimizes chances of injuries.

Post-Isometric Stretch (PNF Method)

- **Underlying principle:** This method of flexibility development is based on the principle of Proprioceptive Neuromuscular Facilitation (PNF).
- In this procedure, the muscle is first contracted maximally for 6-8 seconds using isometric method. After this the muscle is gradually stretched to its maximum limit.
- The final position is held for about 8 to 10 seconds.
- For best effects, the exercise is repeated 4 to 8 times.
- The research has shown that after maximum isometric contraction, a muscle relaxes better when its tension is overcome. A muscle, which is in a state of perfect relaxation, stretches better to its optimum limit.
- This method produces best results among all the procedures of flexibility development

Physiological Background	Dose	Advantage	Disadvantage	Area of Prevention
Static active stretching				
Inhibition of antagonist	Muscle is gently stretched; antagonist is stressed additionally	Easy to learn Many variations Low risk of injury	Low increase in mobility	Starters, children, adults
Repetitive stretching				
Avoidance of neuro-muscular spindle, frequent stretching at the limits	10-30 repetitions	Improvement of interaction between agonist and antagonist	Stimulation of stretch reflex, light stimulation	Prior to all kinds of physical activities
Static passive stretching				
Avoidance of neuro-muscular spindle by stretching slowly	No pain, 10-30 sec stretching, 10-30 sec rest	Low risk of injury	No training of inter-muscular coordination	Do not use prior to training (load) for reasons of muscle tone
Post-isometric relaxation				
Activation of neuro-tendinous spindle leads to "postcontractile inhibition"	8-10 sec moderate exertion, 1-2 sec rest, 7-10 sec stretching	Good effectiveness	Time-wasting/ardous, wilfull execution necessary	Good body perception necessary

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THANK YOU