

PRIME STRENGTH

Progressive Resistance Isolated Muscle Engagement

Once-a-week 40-minute protocol
for improving maximum strength

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In 1970, the Fitness and Amateur Sport Directorate of Health and Welfare Canada established a fitness test called the Canada Fitness Awards to help motivate children and youth to become more physically active. One of the tests was the flexed arm hang, where young people would pull their bodies up on a chin up bar to eye level using their bicep muscles and hold this isometric contraction (no change in muscle length) for as long as possible. This test was often the final determining factor for achieving an Award of Excellence or a Gold, Silver or Bronze level award, or a participation pin.

The flexed arm hang was a difficult test for many children and youth. Although the idea of holding the body at eye level for as long as possible was discouraging for some young people, the scientific evidence suggested that this static exercise was a good indicator of overall upper body strength.

The scientific theory behind the flexed arm hang provides some of the rationale for the PRIME (Progressive Resistance Isolated Muscle Engagement) strength training protocol, which involves completing 5 sets of static dynamic exercises on pin weight exercise machines for 7 major muscle groups in the body.

By isolating the muscle groups on machines, and by performing 5 sets of each exercise that combine controlled static and dynamic repetitions, there are major gains in maximum strength in minimum time with minimal risk of injuring muscles, ligaments and tendons.

Theory behind PRIME

The velocity or cadence at which a strength exercise is performed can affect the adaptations to a training program. Even though the speed might be fast in some

training protocols, such as plyometric exercises for improving muscle power, evidence suggests that training in a controlled manner at a moderate velocity can maximize strength gains while minimizing the strain on the joints, particularly ligaments and tendons. Slow velocity exercises result in less muscle soreness and damage than fast velocity exercises.

The basic premise of PRIME is that a static contraction at the 90-degree angle of a joint, where the force against the opposing muscle is strong, followed by pulsing movements back to 90 degrees, will engage the maximum number of muscle fibers in the contraction based on the all-or-none principle of muscle fiber contraction. According to the theory, there will either be a full response or no response from a muscle fiber depending on the strength of the stimulus. The stimulus needs to be above a certain intensity threshold for all the muscle fibers in a muscle to contract, which the PRIME protocol provides.

Strength training can improve strength, power and muscular endurance, flexibility, motor fitness skills, and sports performance. Strength training can also reduce body fat, improve heart health, lower blood sugar levels, boost mood, improve brain health, and reduce the likelihood of injuries in sports and recreational activities.

There are significant benefits from using the PRIME protocol. Isometric strength is correlated with dynamic strength and can be transferred to many functional movements such as lifting, pushing and pulling heavy objects.

Great for seniors

There are particular PRIME benefits for adults as they age. Strength training diminishes declines in muscle mass, strength, muscular power, muscular endurance and bone loss, and can reduce the likelihood of experiencing pain in the joints, falling and having mobility issues.

PRIME also improves functional abilities that will help seniors complete simple and complex activities of daily living such as carrying groceries, getting out of a chair and climbing stairs.

Mentally challenging

The PRIME protocol is mentally challenging. It is difficult to hold an isometric contraction of a muscle group at a 90-degree angle to fatigue, and to exercise muscle groups to failure.

When muscle groups start becoming fatigued towards the end of the isometric contractions, it is also mentally challenging as it becomes more difficult to breathe because of oxygen debt.

40-MINUTE PROTOCOL

The once-a-week 40-minute PRIME protocol involves spending 4 to 5 minutes completing 5 sets of exercises on 7 different machines for 7 different muscle groups.

The only rest between sets is changing the pin on the machines as the weight is increased for sets 2 and 3 and decreased for sets 4 and 5.

Set 1 (warm-up)

To warm up the muscles, choose a weight where 4 to 6 repetitions through the full range of motion with a minimum 4-second concentric contraction (when muscles shorten) and 4-second eccentric contraction (when muscles lengthen) can be completed. Breathe out on the concentric contraction and in during the eccentric contraction.

Set 2 (increase weight)

This is the first set for putting maximum force on the muscle group. Complete 2 slow repetitions through the full range of motion and then push/pull the weight to 90 degrees and hold the isometric contraction until fatigue. When the weight can no longer be held at 90 degrees, pulse back to the 90-degree angle a few times until the weight can no longer be held, which is often referred to as exercising a muscle group to failure.

Set 3 (increase weight)

This is the second set for putting maximum force on the muscle group. Complete 1 slow repetition through the full range of motion and then push/pull the weight to 90 degrees and hold the isometric contraction until fatigue. When the 90-degree angle can no longer be held, pulse back to the 90-degree angle a few times until failure.

Sets 4 and 5 (decrease weights)

These 2 sets increase blood flow and fluid retention in the muscles, making it feel larger and tighter than normal, which is commonly described as a muscle pump. Completing a minimum of 6 repetitions to failure through 80- to 100-degree angles around the joints with pulsing movements creates the pump. It should take just a few seconds to complete each concentric and eccentric contraction through this 20-degree range of motion. After set 4, the weight is once again decreased for set 5. Remember to exhale during the concentric contraction and breathe in during the eccentric contraction.

After the lower body and upper body exercises have been completed to failure, it is important to complete some static stretches to lengthen the muscles to resting length.

ORDER OF EXERCISES

The PRIME exercises should be performed from larger to smaller muscles groups, lower to upper body. The photographs of the 7 exercises on pages 4 and 5 demonstrate the 90-degree angle at joints for holding the static contractions in sets 2 and 3. The muscle groups that are being strengthened are the first words in the name of each exercise (e.g., Quad press).

The lower body and upper body stretches should be held for about 30 seconds on each side of the body so the muscles can return to normal length after shortening during the concentric contractions. They should be stretched to the point of mild discomfort and held, not bounced.

LOWER BODY STRENGTH

Leg press

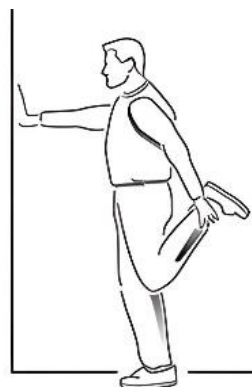


Hamstring curl

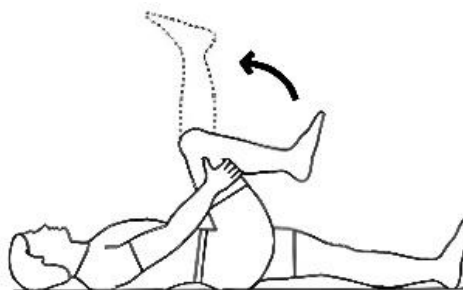


LOWER BODY STRETCH

Quads



Hamstrings



UPPER BODY STRENGTH

Chest press



Back pulldown



Shoulder press



Bicep curl



Tricep pushdown



UPPER BODY STRETCH

Shoulders



Triceps



OPTIONAL PRIME EXERCISES

Additional benefits can be obtained if the protocol in sets 4 and 5 is repeated on different machines right after each of the 7 muscle groups are fatigued.

For each of the optional exercises, the 2 sets should be on machines that can quickly increase blood flow and fluid retention in a muscle group, causing a muscle pump.

Here are some examples of additional exercises for each of the 7 PRIME muscle groups.

Quad extension



Hamstring lying curl



Chest fly



Back sitting rowing



Shoulder parallel raise



Bicep standing curl



Tricep extension



OPTIONAL CORE EXERCISES

It is important to have strong midsection, or core, muscles.

Having a strong midsection is functionally important. Even during a simple task like putting groceries into the trunk of a car, core muscles are working to stabilize the body.

A strong core can also improve posture and balance, reduce back pain, and stabilize the spine.

There are a variety of core exercises, and many of them do not require any equipment. The optional PRIME exercises shown on page 8 require machines.

For the abdominal crunch and lower back extension, completing 3 sets of each exercise to fatigue with a short recovery between sets will strengthen the midsection of the body.

Abdominal crunch



Lower back extension



Feeling PRIME

Unlike many strength training protocols, PRIME has been designed so it is not necessary to record the weight being used and the number of repetitions completed in each set.

There are many ways to adapt the protocol to get the desired outcome. For example, if a lighter weight is used for the warm-up than the week before, the muscles can be warmed up by doing more than 6 repetitions or by slowing the speed of the concentric and eccentric contractions to more than 4-seconds during each of the repetitions. The outcome will be the same. The muscle group will be warmed up and

ready for the first 90-degree isometric contraction in set 2.

If the weight is lighter from the week before for set 2, for example, it will probably take longer to reach fatigue with the isometric contraction. Holding the 90-degree position longer will also achieve the desired outcome of improving maximum strength.

Adaptation and progression

It should only take a few weeks after starting PRIME to adapt to each exercise and to start feeling stronger. As this happens, the weight being used will have to be increased progressively.

By fatiguing the 7 major muscles groups and working to the point of failure during each exercise, maximum strength will improve progressively and consistently.

**PRIME protocol
can be adapted for
multi-station gyms**

**Some exercises
might need to be
completed one side
of the body at a time**



David Carmichael completed a master's degree in physical education with a specialization in the physiology and psychology of coaching at York University in Toronto in 1985. During his career, David was high-performance director at the Ontario Amateur Wrestling Association, director of research and development at the Ontario Physical and Health Education Association and director of national projects at ParticipACTION.