

NAVAL HEALTH RESEARCH CENTER

EXPERT PANEL REVIEW OF NAVAL SPECIAL WARFARE CALISTHENICS: SPORTS MEDICINE CONFERENCE SUMMARY

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Technical Document 95-5E

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EXPERT PANEL REVIEW OF NAVAL SPECIAL WARFARE CALISTHENICS:

SPORTS MEDICINE CONFERENCE SUMMARY

May 4-6, 1994

Naval Amphibious Base

Coronado, California

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Document No. 95-5E, supported by the Navy Medical Research and Development Command, Department of the Navy, Bethesda, Maryland under work unit 60407N 407BB.001-6305. The views expressed in this paper are those of the authors and do not reflect the official policy or position of the Department of the Navy, the Department of Defense, or the U.S. Government. Approved for public release; distribution is unlimited.

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SUMMARY

Problem.

The rigorous physical demands of Naval Special Warfare (NSW) training and mission performance require that SEALs and SEAL candidates develop and maintain excellent physical conditioning. To this end, NSW commands adhere to intensive physical training programs placing them at high risk for musculoskeletal injury. Calisthenics are a fundamental part of the NSW physical training program, yet they have never been evaluated for their contribution to physical training or potential to cause or contribute to injury.

Objective.

The objective of this research was to review the NSW calisthenic program and make recommendations to improve the safety and efficacy of the exercises.

Approach.

A panel of experts was assembled that included sports medicine specialists (physicians, physical therapists, biomechanists, exercise physiologists, and certified athletic trainers) from the United States Olympic Committee, San Diego State University, United States Air Force Academy, Naval Medical Center San Diego, Naval Hospital Camp Pendleton, San Diego Children's Hospital, and Applied Futuristics.

The panel reviewed the calisthenics and made a decision to eliminate, keep, or modify each exercise. The panel also recommended calisthenics to be added to the program.

Results.

Fifty-six exercises were reviewed. The panel recommended that 8 exercises be eliminated, 31 be kept, 17 be modified, and 16 be added.

Conclusions.

It was concluded that NSW personnel could benefit from minor modifications to their existing physical training program. Guidelines for a complete physical training program are needed.

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INTRODUCTION

The first Naval Special Warfare Sports Medicine Conference was held May 4-6, 1994 at the Naval Amphibious Base, Coronado, California. The Conference was co-hosted by Commander Naval Special Warfare Command (COMNAVSPECWARCOM) and the Naval Health Research Center (NHRC), and funded by the Special Operations Research, Development and Acquisition Center. The Conference was attended by Naval Special Warfare (NSW) operators from East and West Coast commands, medical officers, researchers, and a panel of sports medicine specialists.

The Conference was initiated by NHRC in collaboration with the Department of Sports Medicine, Naval Hospital, Camp Pendleton. The Conference was convened to review the NSW calisthenic program and identify exercises thought to be "contraindicated," or likely to cause injury. Initially, NHRC researchers explored the scientific literature, but were unable to find any studies which identified specific exercises that cause injuries. There are inherent difficulties in conducting such studies because they require tracking thousands of people for several years, documenting all physical activities they perform and all injuries they develop. A more practical approach to the problem was needed. It was thought that a broader perspective of NSW calisthenics could be obtained by assembling a panel of recognized experts to review current practices and make informed recommendations.

Representatives from the United States Olympic Committee, San Diego State University, United States Air Force Academy, Naval Medical Center San Diego, Naval Hospital Camp Pendleton, San Diego Children's Hospital, and Applied Futuristics composed the expert panel of sports medicine specialists (physicians, physical therapists, biomechanists, exercise physiologists, and certified athletic trainers). Armed with video tapes featuring a COMNAVSPECWARCOM brief and demonstrations of current NSW calisthenics, panel members arrived prepared to provide recommendations to improve both the safety and quality of NSW physical training.

The 3-day conference was divided into two parts. First, a review of NSW calisthenics was conducted. Second, work-group discussions were conducted on selected topics in the areas of exercise science and sports medicine. A document containing an edited transcript of the entire 3-day conference including: (1) a section on the epidemiology of musculoskeletal injuries in NSW candidates and operators; (2) a narrative of the panel's review of NSW calisthenics; (3) stretching, conditioning, and injury-prevention recommendations; and (4) the panel's general recommendations regarding strength and conditioning is available as NHRC TD# 95-4D.

This document contains a detailed review of the panel's recommendations regarding the NSW calisthenics program. It is divided into two main sections: stretching and conditioning. Within each section, those calisthenics the panel recommended be kept, modified, or added are addressed first. Calisthenics the panel recommended for elimination

are addressed last. The calisthenics are listed in anatomical order, from head to foot. Table 1 contains an alphabetical list of exercises reviewed, the panel's main recommendation for each exercise, and the page where the discussion can be found in this document. Anatomical terms are defined and illustrated in Appendix A. Where panel information was inconsistent or incomplete, researchers supplemented findings using the scientific literature as the basis for their recommendations.

Table 1. Calisthenics Reviewed and Summary of Panel Recommendations

EXERCISE	ELIM.	KEEP	MOD.	ADD	PAGE #
2&4 Count Windmills	X				24
8-Count Body Builders		X			34
Back Benders		X			18
Back Stretch	X				26
BUD/S Knee		X			21
Burt Reynolds				X	52
Butterflies			X		20
Cherry Pickers	X				25
Chest Stretch		X			6
Chin-Ups		X			35
Cross-Overs (Stretches)	X				25
Crunches		X			41
Dips		X			37
Dirty Dogs		X			51
Dive Bomber Push-Ups		X			32
Donkey Kicks				X	52
Elbow to Knee Cross-Overs		X			40
Finger-Tip Push-Ups				X	33
Flutter Kicks			X		43
Gastrocnemius Stretch				X	22
Good Morning Darlings			X		43
Groin Stretcher		X			16
Hand to Toe Sit-Ups	X				55
Helen Kellers/Nuclear Sit-Ups			X		47
Hip Stretch				X	15

Table 1. Calisthenics Reviewed and Summary of Panel Recommendations (Cont.)

EXERCISE	ELIM.	KEEP	MOD.	ADD	PAGE #
Hip Rollers		X			42
Hurdler's Stretch (Hamstring)		X			18
Hurdler's Stretch (Quads)		X			16
Iliopsoas Stretch				X	15
Inboard/Outboards			X		44
Incline Pull-Ups				X	37
Jack/Jills		X			8
Jane Fondas			X		47
Jumping Jacks		X			29
Knee Benders (Supine/Seated)			X		45
Leg Levers			X		44
Neck Rotations			X		29
One-Legged Squat				X	54
Penguin Walk		X			22
Plyometrics		X			53
Posterior Shoulder Stretch				X	7
Press-Press-Fling		X			8
Prone Back Extension		X			50
Prone Flutter Kicks		X			49
Pull-Ups		X			36
Push-Ups With a Plus				X	34
Push-Ups		X			31
Seated Head to Knee			X		19
Side Flex		X			48
Single Leg Hamstring Stretch				X	19
Sitting Flutter Kicks			X		48

Table 1. Calisthenics Reviewed and Summary of Panel Recommendations (Cont.)

EXERCISE	ELIM.	KEEP	MOD.	ADD	PAGE #
Soleus Stretch				X	23
Standing Head to Knee	X				24
Standing Calf Stretch	X				26
Standing Quad Stretch				X	17
Standing Toe Pointers		X			21
Stomach Pump-Ups		X			42
Sun Gods		X			30
Supine Hamstring Stretch				X	20
Supine Back Stretch				X	10
Swimmer's Stretch			X		7
The Superman				X	50
Thigh Stretch (2 Person)	X				27
Torso Prone Stretch		X			10
Triceps Push-Ups		X			32
Triceps Stretch		X			9
Trunk Bending Fore and Aft			X		14
Trunk Side Stretch			X		12
Trunk Twisters			X		11
Trunk Rotations			X		13
Up, Back, Over		X			9
Vee-Ups			X		46

I. STRETCHING

Stretching Terms:

Ballistic Stretch - Ballistic stretching uses the momentum of a moving body or limb to force it beyond its normal range of motion. Although closely related to dynamic stretching, ballistic stretching incorporates bouncing or jerky movements, using the momentum of the limb to spring back to the starting position (e.g., bouncing down repeatedly to touch toes). **This type of stretch is not recommended because repeated activation of the stretch reflex causes muscles to tighten which can lead to injury.**

Dynamic Stretch - Dynamic stretching consists of controlled movement of the limbs, gradually increasing reach, speed of movement, or both. In dynamic stretching there are no bounces or jerky movements. It uses slow, controlled leg swings, arm swings, torso twists, etc. Dynamic stretching can be performed prior to a workout in order to stretch those muscles which are to be used during the exercise session (i.e., Jack and Jills or Up Back and Overs prior to swimming). Stretching should always be preceded by a warm-up.

Static Stretch - Static stretching (sometimes referred to as passive stretching) involves holding a position using a part of your body, the assistance of a partner, or some other apparatus such as a pole or the floor (e.g., lifting one leg up and holding it with the hand, the splits). Slow, static stretching is used for cooling down after a workout to reduce muscle fatigue and soreness, and can help relieve muscle spasms due to exercise.

A. STRETCHING EXERCISE REVIEW (KEEP, MODIFY, OR ADD)

Many of these exercises (Chest Stretch, Swimmer's Stretch, Posterior Shoulder Stretch, Up Back and Overs, Jack and Jills, Triceps Stretch) are dynamic stretches that can be done both before and after a workout. These are particularly useful if the workout involves swimming, push-ups, pull-ups, or upper-body weight training.

1. Chest Stretch



Description: Begin from a standing position with arms extended to the side at shoulder level. While keeping the thumbs pointed up, extend the arms backward. Either have another person hold the stretch or use a pole for resistance.

Type of Exercise: Static stretch for the anterior shoulder and chest muscles.

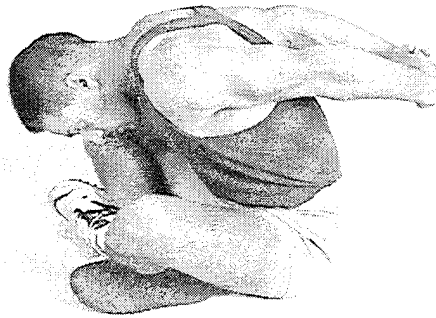
Recommendation: Keep.

Discussion: This exercise should be performed in external rotation (thumbs pointed up).

2. Swimmer's Stretch



Not Recommended



Recommended

Description: Clasp hands together behind the lower back, palms up. While bending over from the waist, slowly pull the arms up and toward the head.

Type of Exercise: Static stretch for the chest and anterior shoulder muscles.

Recommendation: Modify. Perform this exercise either seated or standing without bending over. This stretch should be performed with thumbs pointing downward throughout the stretch.

Discussion: This exercise is often performed while bending over at the waist. This technique was not recommended because it puts undue mechanical stress on the back.

3. Posterior Shoulder Stretch



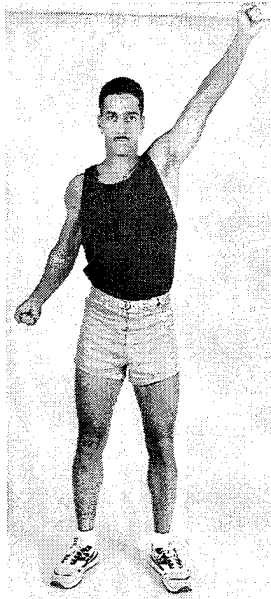
Description: Bring the arm that is to be stretched across the chest. Use the opposite arm to pull the arm being stretched towards the chest until the stretch is felt in the posterior shoulder.

Type of Exercise: Static stretch for the posterior shoulder muscles.

Recommendations: Add.

Discussion: There are several stretches used during NSW calisthenics for the anterior shoulder muscles, but none for the posterior shoulder muscles.

4. Jack and Jill

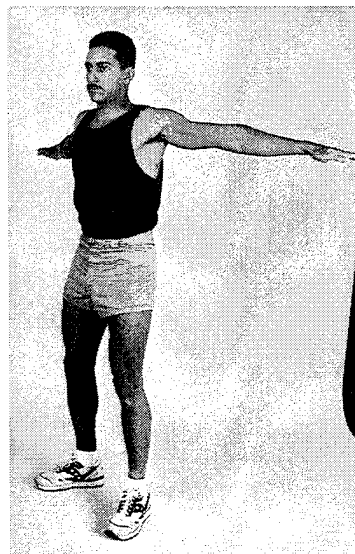


Description: This is a four-count exercise. Begin from a standing position, with one arm elevated above the head and the other arm down and slightly away from the body. On the first count both arms are pulled backward, stretching the chest muscles, and released. The second count repeats the first movement. On the third count, arms exchange positions and again pull toward the back and release. Repeat this movement on the fourth count.

Type of Exercise: Dynamic stretch for the chest and anterior shoulder muscles.

Recommendation: Keep. This exercise should be performed slowly with controlled movement.

5. Press-Press-Fling

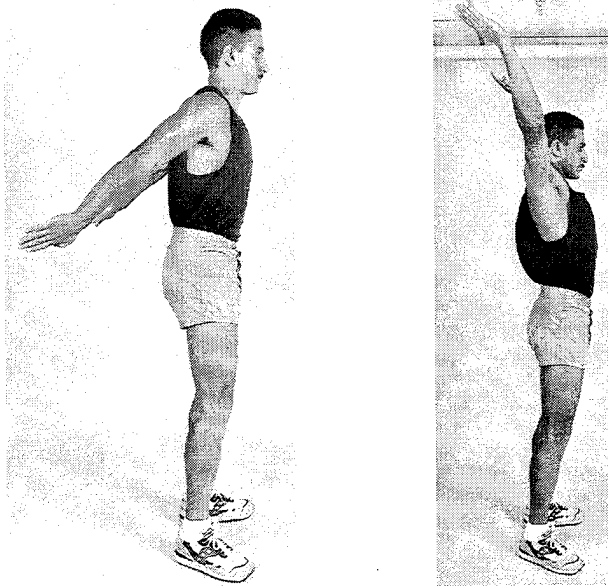


Description: This is a three-count exercise. Begin from a standing position with arms bent, fists midline at chest level, and elbows out to the side. On the first count, pull elbows backwards towards the midline of the back, stretching the chest muscles, and release. Repeat the same movement on the second count. On the third count, extend arms out and backward, stretching the chest muscles.

Type of Exercise: Dynamic stretch for the chest and anterior shoulders.

Recommendation: Keep. This exercise should be performed slowly with controlled movement.

6. Up Back and Over

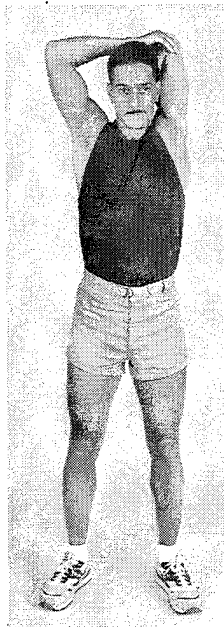


Description: This is a four-count exercise. Begin from a standing position with arms at sides. On the first count, bring both arms forward and upward. On the second count, bring both arms down and back. On the third and fourth counts, bring both arms forward, up, back, and around to complete a full circle.

Type of Exercise: Dynamic stretch for the shoulders, chest, and back.

Recommendation: Keep. This exercise should be performed slowly with controlled movement.

7. Triceps Stretch

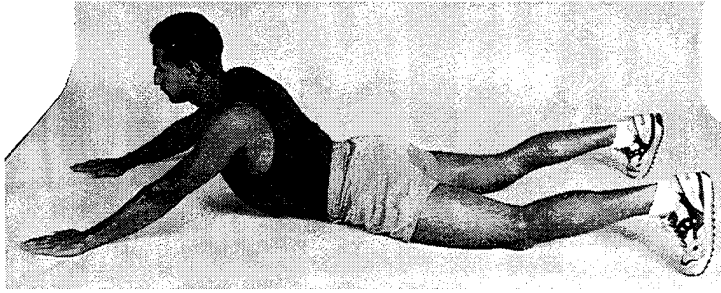


Description: Standing erect, bring the arm to be stretched up and back so that the elbow is pointing toward the sky and the hand rests between the shoulder blades. Gently pull the arm toward the midline behind the head to stretch the triceps muscle.

Type of Exercise: Static stretch for the triceps.

Recommendation: Keep.

8. Torso Prone Stretch (Press-Ups)



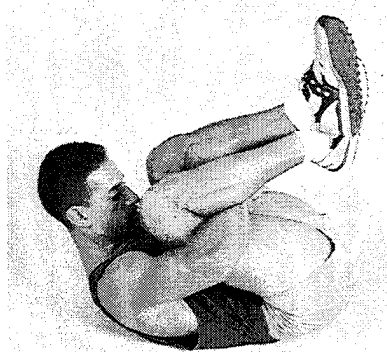
Description: Begin lying on stomach (prone) with hands flat on the deck as for a push-up. Extend the arms so that the upper torso lifts off the deck.

Type of Exercise: Static stretch for the abdominals.

Recommendation: Keep.

Discussion: This exercise serves as a passive abdominal stretch, usually following abdominal strengthening exercises such as sit-ups. The goal of this exercise is not to fully extend the arms, but to stretch the abdominals. Therefore, the stretch should only be done to the point that the pelvis begins to lift off the deck.

9. Supine Back Stretch



Description: While lying on back (supine), bring both knees up and toward the chest. Place the hands behind the knees and gently pull both legs toward the chest, stretching the back muscles.

Type of Exercise: Static stretch for the back extensors.

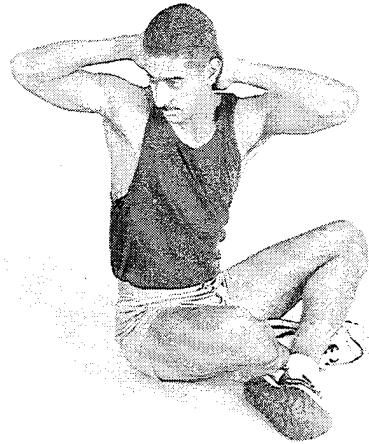
Recommendation: Add.

Discussion: This is an excellent stretch for the lower back. It can help relieve muscle spasm and reduce the risk of injury (muscle strain) to the back muscles. When performing this stretch, one may initially feel increased tightness or pain. When a muscle is stretched, an automatic reflex will initially cause the muscle to contract. Therefore, this stretch should be held until one can feel the muscle relax and the tightness subside. Some physical therapists recommend this stretch be held for over a minute.

10. Trunk Twisters



Not Recommended



Recommended

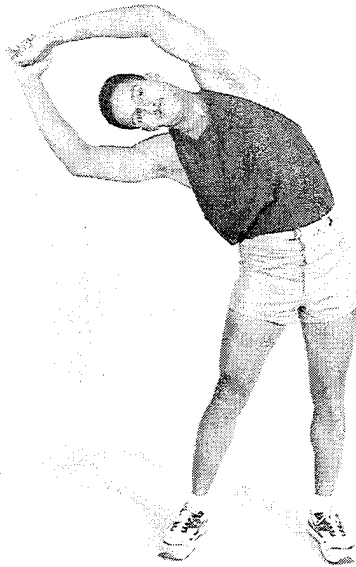
Description: Starting from a standing position with hands behind the head, twist the upper torso to one side, and then to the other.

Type of Exercise: Dynamic stretch for the abdominals, including the obliques.

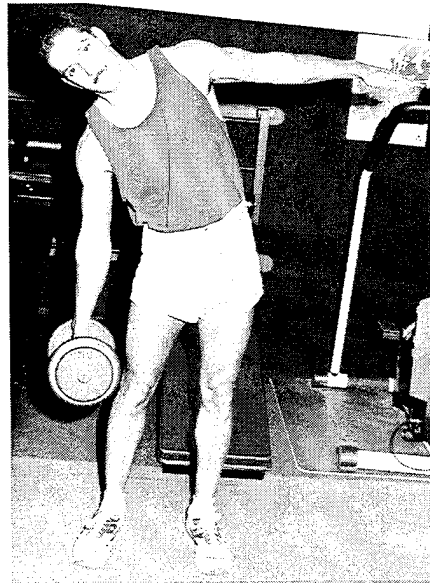
Recommendation: Modify. This exercise should be performed seated using controlled movements.

Discussion: This exercise is frequently performed in a misguided attempt to strengthen the abdominals. It should be performed from a seated position (instead of standing) to avoid placing stress on the knee.

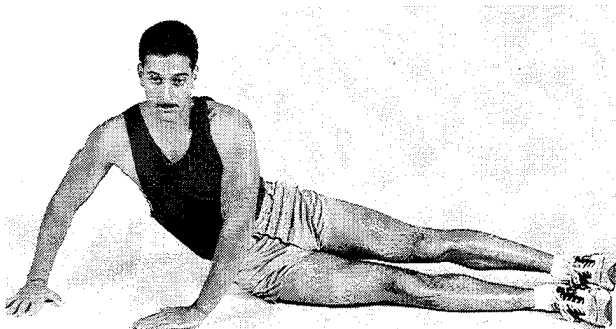
11. Trunk Side Stretch



Recommended Stretch



Recommended Strength



Recommended Stretch

Description: Standing straight, arms either above the head or straight to the sides, bend the torso to the side and hold. Return to starting position and repeat to the other side.

Type of Exercise: This exercise can be either a static stretch or strengthening exercise for the abdominal obliques depending on how it is performed.

Recommendation: Modify. This exercise should be performed according to its intended use; either as a stretch or strengthening exercise.

Discussion: If the exercise is performed as a stretch, it is best done passively, lying on the ground, and holding for approximately 10 seconds. If the exercise is performed to develop strength, load the muscles by adding hand-held weights.

12. Trunk Rotations

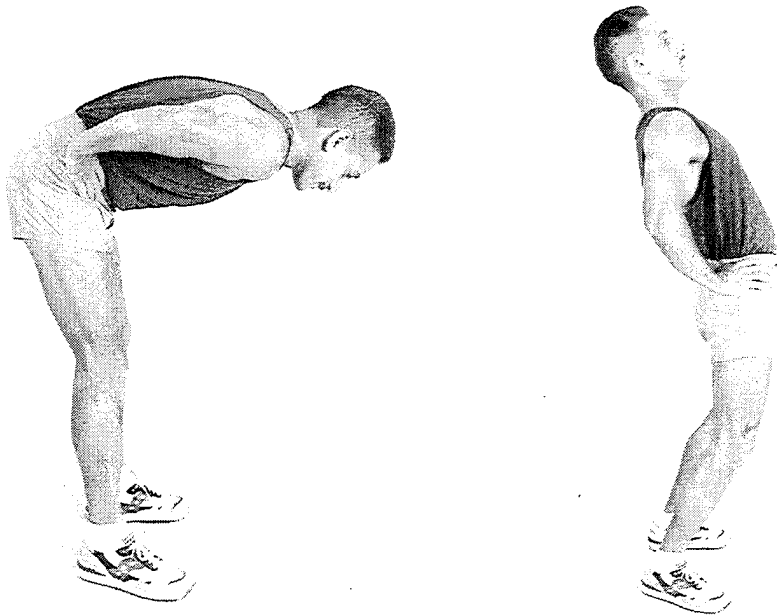


Description: This is a four-count exercise beginning from a standing position with legs shoulder-width apart, knees slightly bent. On the first count, bend forward at the waist flexing the torso. On the second count, bend the torso laterally. On the third count, extend the torso backward, and on the fourth count, bend the torso laterally to the remaining side.

Type of Exercise: Dynamic stretch for the abdominals, including the obliques, and hip flexors.

Recommendation: Modify. Perform this exercise slowly and with bent knees. Keep the legs slightly bent when bending backwards to avoid hyperextension of the back.

13. Trunk Bending Fore and Aft



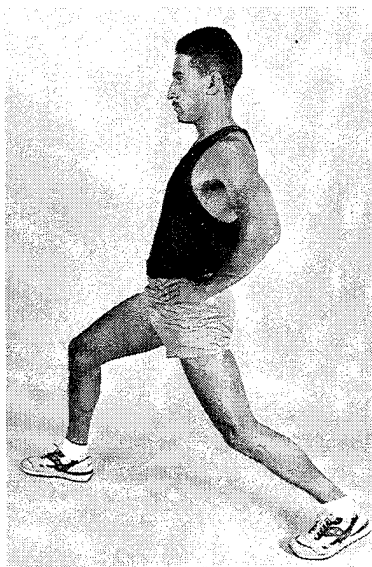
Description: Standing straight, knees slightly bent, bend the trunk forward and then back.

Type of Exercise: Static stretch for the hip flexors.

Recommendation: Modify. Keep the legs slightly bent when bending backwards to avoid hyperextension of the back.

Discussion: The purpose of this exercise is NOT to stretch the abdominals, but to stretch the muscles that flex the hips. Overdevelopment of the hip flexors plays a major role in the development of low-back pain. The iliopsoas muscles are the strongest flexors of the hip joint. They arise from the lumbar vertebrae and the inner aspect of the hip bone, and insert into the inner aspect of the femoral shaft (see Appendix A). Overdeveloped hip flexors not only change the curvature of the spine, but also stress the front portion of the vertebral discs, thus playing a major role in the development of chronic low-back pain. One of the main points made by the panel was that the current NSW calisthenic program includes an excessive number of exercises for strengthening hip flexors. Therefore, it is imperative that stretches for the iliopsoas muscle (i.e., Iliopsoas Stretch) be incorporated into the calisthenic program.

14. Iliopsoas Stretch



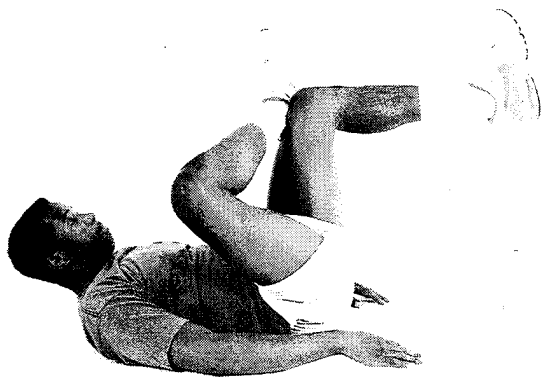
Description: Begin from a standing position. Step forward with one leg, placing one foot in front of the other. Keep both legs slightly bent. Weight should be distributed toward the front foot. Flatten the back and tuck the hips under, stretching the iliopsoas muscle on the front of the back leg. For added stretch, either lean slightly back with the upper torso or bend further at the knees.

Type of Exercise: Static stretch for the iliopsoas muscle.

Recommendation: Add.

Discussion: The Iliopsoas Stretch should be incorporated into the NSW calisthenic program to offset the excessive number of hip flexor conditioning exercises in the current NSW calisthenic program. As previously stated, overdevelopment of hip flexors plays a major role in the development of low-back pain.

15. Hip Stretch



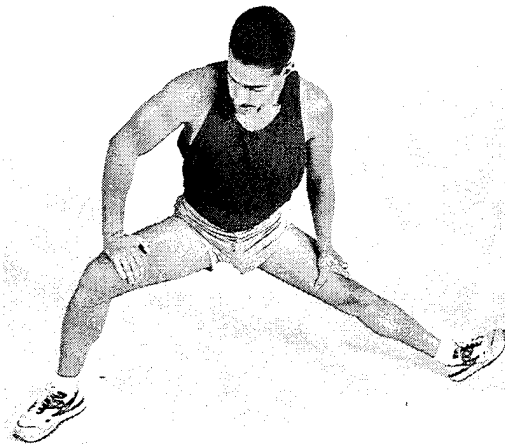
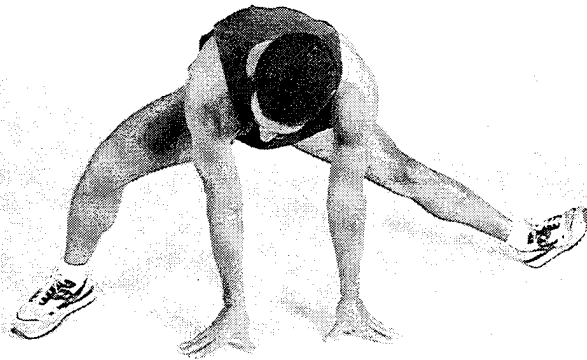
Description: Begin by lying with back on the deck, knees bent, and feet flat on the deck. Cross one leg so that the ankle is resting on the knee of the other leg. Slowly lift the one leg off the deck and move it toward the chest. Stretch should be felt in the hip of the crossed leg.

Type of Exercise: Static stretch for hip extensors.

Recommendation: Add.

Discussion: This stretch should be added as there are currently no stretches which isolate the hip extensors.

16. Groin Stretcher



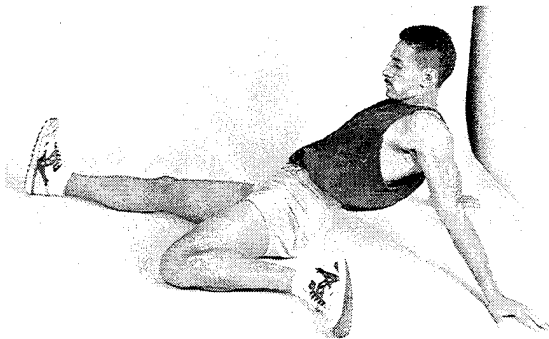
Description: Begin standing, with legs far enough apart to allow for sufficient stretch and toes pointed slightly outward. Shift body weight to one side while bending the leg on that side. The stretch should be felt on the inner aspect of the thigh of the straight leg.

Type of Exercise: Static stretch for leg adductors.

Recommendation: Keep. Pay proper attention to technique.

Discussion: Ample time should be allowed to get into proper position for this stretch, and it should be held for at least 10 seconds. The bent knee should always be aligned vertically over the heel, and should never exceed 90° of flexion. The compression behind the kneecap increases markedly at 60° of flexion, and increases even more markedly at 90° of flexion. Keeping the knee aligned over the toe is an easy way to ensure proper technique. This stretch may be performed upright or bent over at the waist, provided the weight of the upper body is supported by the arms. The angle of the bent knee should always remain less than 60 to 90°. If more stretch is needed, the leg being stretched may be elevated, as on the upward slope of a hill. Keep the foot of the leg being stretched pointed upward.

17. Hurdler's Stretch (Quad Stretch)



Description: Begin from a sitting position, extend one leg forward and out. Keep the other leg flexed and tucked behind the hips. Either lean back until the upper torso rests on the deck, or gradually extend the upper torso backward to stretch the muscles in the bent leg.

Type of Exercise: Static stretch for the leg extensors and hip flexors.

Recommendation: Keep, however pay special attention to technique. The Standing Quad Stretch may be a more effective exercise.

Discussion: There is a potential for injury to the menisci and ligaments of the bent knee. This exercise, if performed at all, should begin from a seated position, leaning back until the leg begins to come off the ground. The panel suggested that the Iliopsoas Stretch and the Standing Quad Stretch be added as they are more efficient exercises for the hip flexor and/or leg extensor muscles as these exercises do not stress the knee.

18. Standing Quad Stretch

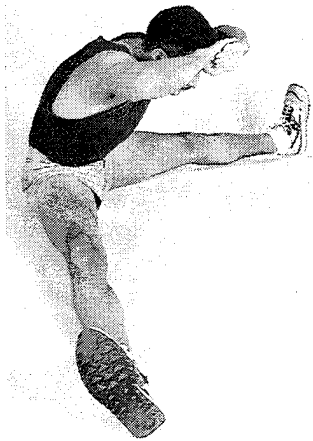


Description: While standing, bend one leg back toward the buttocks stretching the front of the bent leg. Use the hand on the same side as the bent leg to hold the stretch. Tilting the pelvis forward will engage the hip flexors. Knees should be kept parallel, underneath the hips.

Type of Exercise: Static stretch for the leg extensors and hip flexors.

Recommendation: Add.

19. Back Benders



Description: Begin from a seated position with legs extended out and to the side as far as possible, arms bent, and hands on the forehead. Bend the upper torso forward stretching the back of the legs and the groin.

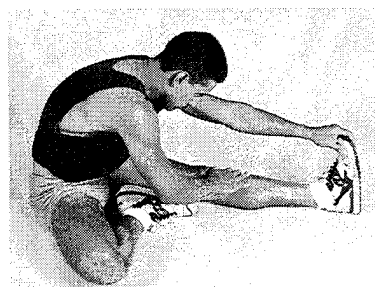
Type of Exercise: Static stretch for leg flexors and hip/thigh adductors.

Recommendation: Keep. Pay close attention to technique.

Discussion: Keep the back straight throughout this exercise because of the potential for injury to the discs and lower back. The purpose is to stretch the muscles in the legs, not to touch your nose to the ground.

The panel suggested changing the name of this exercise to reflect the actual muscle groups being stretched (i.e., leg flexors and leg adductors).

20. Hurdler's Stretch (Hamstring)

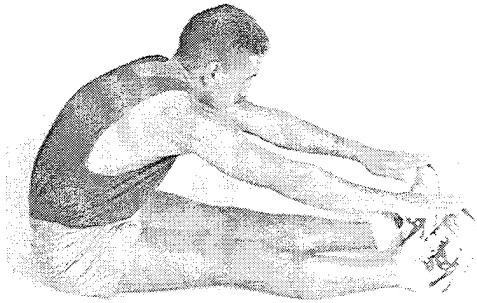


Description: From a sitting position, extend one leg out while tucking the other leg in front of the hips with the knee pointing outward. Bend the torso forward toward the knee of the extended leg, stretching the muscles in the back of the leg.

Type of Exercise: Static stretch for the leg flexors.

Recommendation: Keep

21. Seated Head to Knee (Sitting Hamstring)



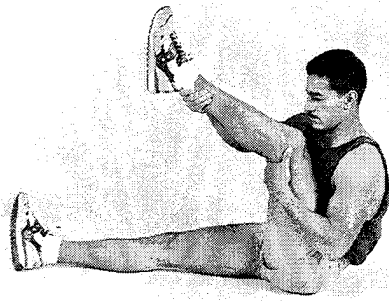
Description: From a sitting position, extend the legs forward and bend the torso toward the knees, stretching the back of the legs.

Type of Exercise: Static stretch for the leg flexors.

Recommendation: Modify. Keep the knees slightly bent and the back flat throughout.

Discussion: Other suggestions included adding the Single Leg Hamstring Stretch and the Supine Hamstring Stretch.

22. Single Leg Hamstring

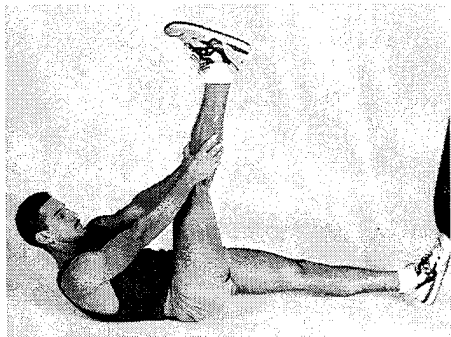


Description: From a sitting position, bring one knee up to the chest and extend the leg. Hold the stretch by grasping behind the knee. Keep back flat throughout stretch.

Type of Exercise: Static stretch for the leg flexors.

Recommendation: Add.

23. Supine Hamstring

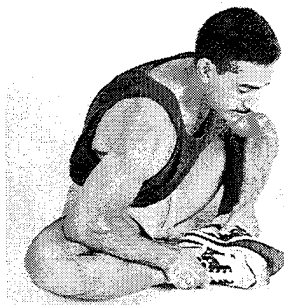


Description: Begin by lying with back flat on the deck (supine). Bending at the knees, bring one leg toward the chest grasping the leg with both hands just below the knee. Slowly extend the bent leg while keeping the back flat on the deck.

Type of Exercise: Static stretch for the leg flexors.

Recommendation: Add.

24. Butterflies



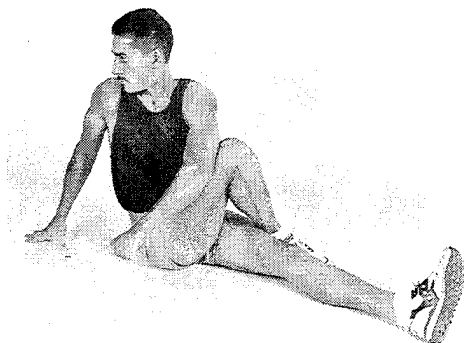
Description: Begin by sitting with legs bent and the bottoms of the feet together. Grasp the feet and push the legs to the floor using the elbows while bending the upper torso toward the feet.

Type of Exercise: Static stretch for the hip/thigh adductors.

Recommendation: Modify. Keep the back flat and grasp the ankles instead of the toes.

Discussion: Flattening the back decreases the stress on the lower back and ensures that the correct muscles are being stretched. Grabbing the ankles instead of the toes prevents one from pulling on the ligaments of the ankle (flexor retinaculum, the calcaneofibular, lateral talocalcaneal, and deltoid). These ligaments, located on the lateral aspect of the ankle (i.e., side facing out), are the ones most commonly damaged by ankle sprains.

25. BUD/S Knee (ITB Stretch)



Description: Perform while seated, with one leg extended, and the other leg crossed over the extended leg at the knee. Turn the upper torso toward the bent leg stretching the iliotibial band of that leg. Use the elbow on the side of the straight leg to hold the stretch.

Type of Exercise: Static stretch for the trunk and iliotibial band.

Recommendation: Keep.

Discussion: This exercise was highly recommended due to the high frequency of iliotibial band injuries caused by running.

26. Standing Toe Pointers



Description: Start from a standing position with body weight over the heels. Flex and extend the feet and toes. Stretch should be felt in both the calf muscles (gastrocnemius) and muscles in front of the shins (anterior tibialis). As an alternative, walk on the heels with toes pointed upward.

Type of Exercise: Dynamic stretch for the gastrocnemius. Conditioning exercise for the anterior tibialis.

Recommendation: Keep. This is a good prunning stretch that helps prevent shin splints.

27. Penguin Walk

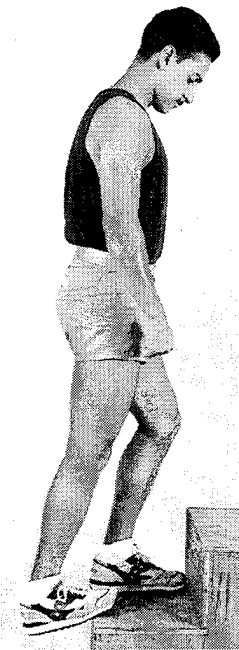


Description: While standing with the weight over the heels, flex feet and toes upward, stretching the calf muscles. Maintain this position and walk on the heels.

Type of Exercise: Static stretch for the gastrocnemius. Conditioning exercise for the anterior tibialis.

Recommendation: Keep.

28. Gastrocnemius Stretch



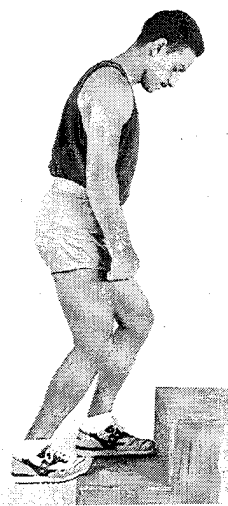
Description: Standing on a tilt board, on the edge of a stair, or curb, flex the foot stretching the calf muscles. Keep the leg of the stretched muscle straight.

Type of Exercise: Static stretch for the gastrocnemius muscle.

Recommendation: Add.

Discussion: Two muscles, the gastrocnemius and the soleus, comprise the calf musculature. The Gastrocnemius Stretch and the Soleus Stretch can also be performed dynamically. Both are good exercises to be done prior to a workout involving running or walking. Remember to warm-up prior to stretching.

29. Soleus Stretch



Description: Standing on a tilt board, on the edge of a stair, or curb, flex the foot stretching the calf muscles. Bending the knee of the leg being stretched will engage the soleus.

Type of Exercise: Static stretch for the soleus muscle.

Recommendations: Add.

Discussion: The soleus and the gastrocnemius muscles comprise the calf musculature. The Gastrocnemius Stretch and the Soleus Stretch are both good exercises to be done prior to a workout involving running or walking. Remember to warm-up prior to stretching.

B. STRETCHING EXERCISE REVIEW - (ELIMINATE)

1. 2 & 4 Count Windmills



Description: This is a four-count exercise. Begin with feet shoulder-width apart and arms extended laterally while bending over at the waist. On the first count, touch the left foot with the right hand while bending at the waist. On the second count, return to starting position. On the third count, touch the right foot with the left hand and return to starting position on the fourth count.

Type of Exercise: Dynamic stretch for back extensors and leg flexors.

Recommendation: Eliminate.

Discussion: This exercise has the potential for injury to the discs and lower back. Bending over statically at the waist increases spinal disc pressure by 400%.

2. Standing Head to Knee



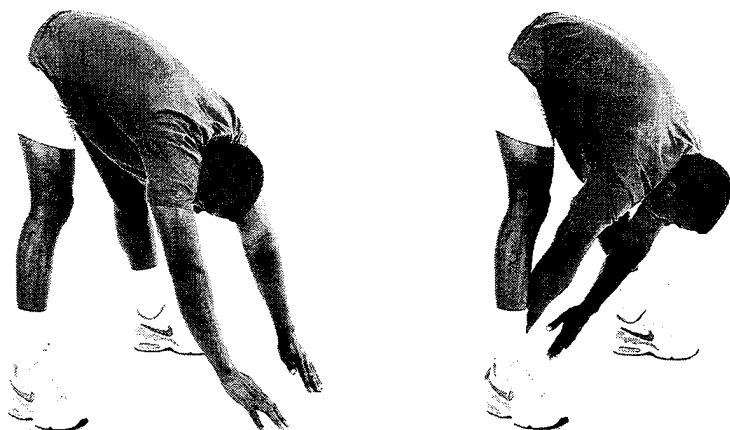
Description: Begin from a standing position. Bend forward at the waist, pulling the torso toward the knees while grabbing the back of the legs.

Type of Exercise: Static stretch for back extensors and leg flexors.

Recommendation: Eliminate.

Discussion: This exercise has the potential for injury to the discs and lower back. Bending over statically at the waist increases spinal disc pressure by 400%. This exercise should be replaced with the Single Leg Hamstring and/or the Supine Hamstring Stretch.

3. Cherry Pickers



Description: This is a four-count exercise starting from a standing position with hands on hips. On the first count, bend forward and reach toward the ground. On the second count, lift the torso slightly up and bounce back toward the ground, reaching further back with the arms to increase the stretch. On the third count, again lift the torso slightly and bounce back toward the ground, reaching between the legs and touching the ground. On the fourth count, return to starting position.

Type of Exercise: Ballistic stretch for back extensors and leg flexors.

Recommendation: Eliminate.

Discussion: This exercise has a high potential for injury to the discs and lower back.

4. Cross-Overs (Standing Hamstring)



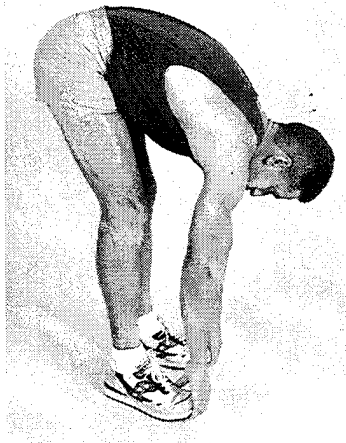
Description: Begin from a standing position with one leg crossed in front of the other. Bend forward from the waist and touch the toes.

Type of Exercise: Static stretch for the back extensors and leg flexors.

Recommendation: Eliminate.

Discussion: This exercise has a potential for injury to the discs and lower back.

5. Standing Calf Stretch



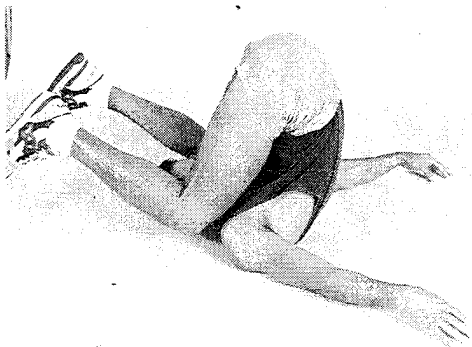
Description: Begin from a standing position. Bend forward from the waist, grab the toes, and pull up stretching the calves.

Type of Exercise: Static stretch for the calf muscles.

Recommendation: Eliminate.

Discussion: This exercise has a potential for injury to the back. Replace it with the Gastrocnemius Stretch and the Soleus Stretch.

6. Back Stretch



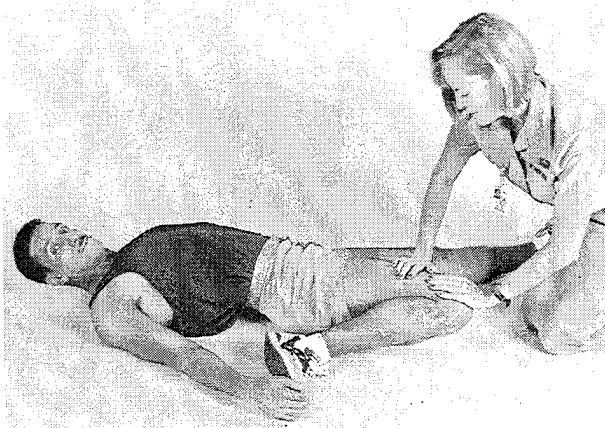
Description: Starting from a sitting position, bring legs up and over until they touch the deck above the head.

Type of Exercise: Static stretch for the back extensors.

Recommendation: Eliminate.

Discussion: This exercise has a potential for injury to the cervical spine. It should be replaced by the Supine Back Stretch.

7. Thigh Stretch (2 person)



Description: Begin exercise lying on the back with one leg extended and the other tucked behind the hips. A second person then gently presses the bent leg towards the deck.

Type of Exercise: Static stretch for the leg extensors.

Recommendation: Eliminate.

Discussion: This exercise has the potential for injury to the knee. It should be replaced with the Standing Quad Stretch.

II. CONDITIONING

Conditioning calisthenics have the potential to develop or maintain muscle strength and endurance, depending on an individual's fitness level. For example, individuals who can only perform a low number of repetitions (less than 10 to 12) will develop muscle strength, while those who can perform a higher number (more than 12) will develop muscle endurance. In general, calisthenics develop endurance, and high-resistance weight workouts develop strength; however, adding weight to a calisthenic program (e.g., pull-ups or push-ups while wearing a weighted pack) will develop muscle strength.

Conditioning Terms:

Aerobic Exercise: Aerobic exercise develops cardiovascular fitness. It involves performing moderate to high-intensity exercise with large muscle groups for a prolonged period of time. Examples of aerobic activities are running, swimming, cross-country skiing, cycling, and rowing.

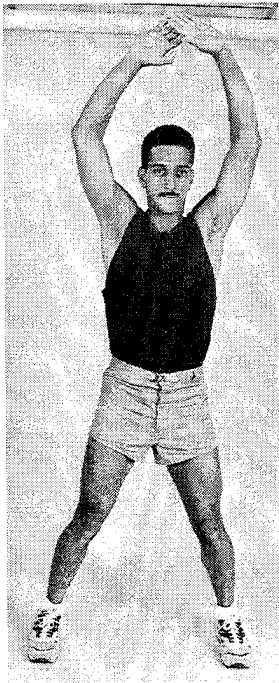
Muscle Endurance: Muscle endurance refers to the ability of a muscle group to exert force repeatedly against resistance or hold a static contraction over a period of time before the muscle becomes fatigued. An example of muscle endurance is the number of pull-ups a person can perform in 1 minute. Muscle endurance is important for such tasks as rock climbing or carrying objects over a distance.

Muscle Power: Muscle power, closely related to muscle strength, is the force generated by a specific muscle or muscle group over a specified amount of time. Whereas muscle strength is a measure of force against resistance, muscle power is a measure of the amount of force over distance (i.e., work) per unit of time. The development of muscle power enhances the ability to perform explosive movements requiring sudden bursts of energy over a short period of time (e.g., sprinting, jumping). Plyometric exercises (e.g., Lunges, Bunny Hops, Side Jumps, Bench Jumps, Side to Sides) can be used to develop muscle power.

Muscle Strength: Muscle strength is the force generated by a specific muscle or muscle group against resistance in a single effort. For example, a measure of upper-body strength would be the maximum amount of weight a person can bench press for one repetition. Muscle strength is necessary for tasks that require moving heavy objects (e.g., equipment, body weight) in a single bout or over a short distance.

A. CONDITIONING EXERCISE REVIEW (KEEP, MODIFY, ADD)

1. Jumping Jacks



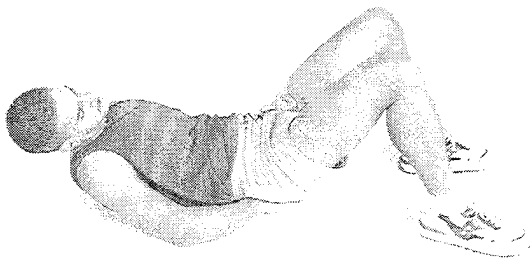
Description: This is a four-count exercise. Begin from a standing position with feet together and hands at sides. On the first count, jump up while bringing hands together over the head and landing with feet apart. On the second count, jump back to the starting position. The third count repeats the action performed during the first count, and on the fourth count return to the starting position.

Type of Exercise: Aerobic.

Recommendation: Keep.

Discussion: This is a good warm-up exercise.

2. Neck Rotations

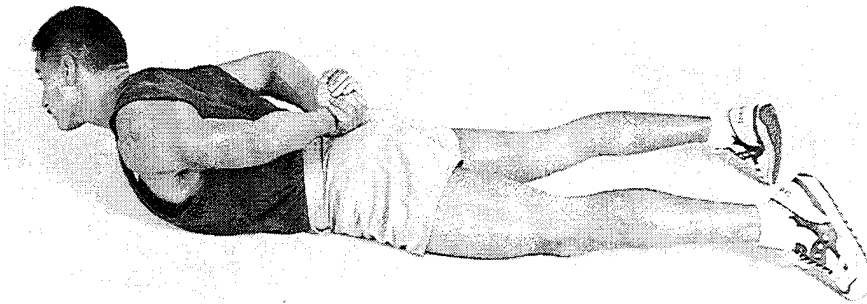


Description: This is a four-count exercise. Begin lying on back, and on the first count, lift the head up and over to the side. On the second count, lift the head straight up, and on the third count, bring the head to the remaining side. On the fourth count, head returns to starting position.

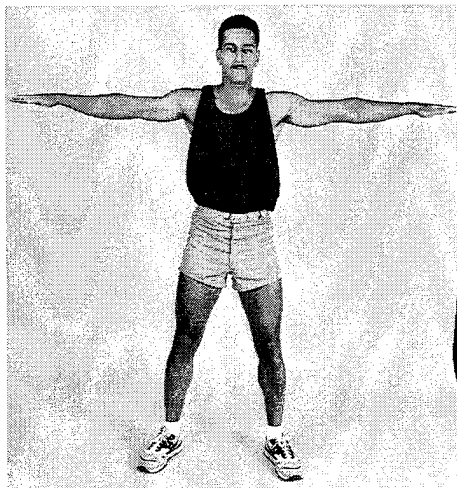
Type of Exercise: Conditioning exercise for the neck flexors.

Recommendation: Modify. Exercise should also be done while lying on stomach.

Discussion: This exercise should also be performed while lying on the stomach in order to strengthen the neck extensors which move the head back. If the goal is to strengthen the neck, some form of resistance should be added (e.g., a towel or hand).



3. Sun Gods (Air Circles)

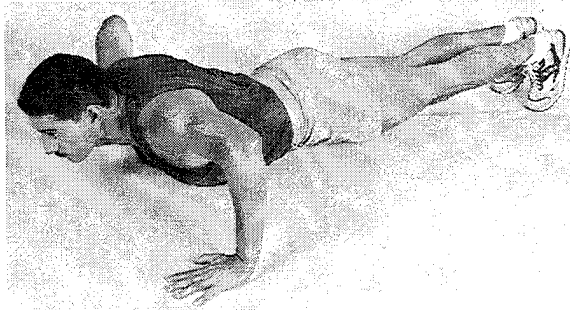


Description: Extend the arms out and to the side and move them in small circles.

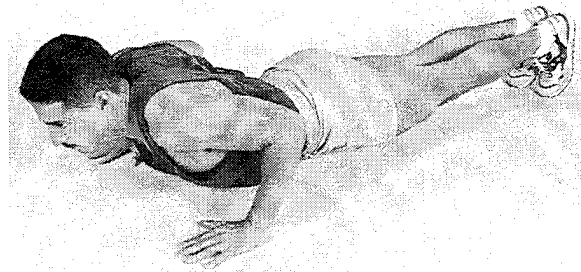
Type of Exercise: Endurance exercise for shoulder muscles.

Recommendation: Keep.

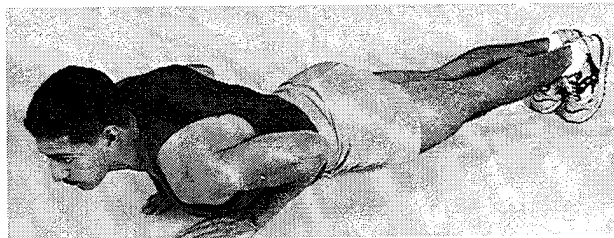
4. Push-Ups Wide, Standard, and Narrow Push-Ups



Wide Push-Up



Standard Push-Up



Narrow Push-Up

Description: This is a two-count exercise. Begin lying on the stomach with hands and feet on the deck, the arms extended, and the head facing forward. On the first count, bend the elbows to at least a 90° angle, lowering the chest toward the deck. On the second count, extend the arms back to the starting position.

Type of Exercise: Conditioning exercises which primarily incorporate chest and anterior shoulder muscles, and secondarily incorporate the triceps and abdominal muscles.

Recommendation: Keep.

Discussion: These exercises should be performed first with the hands placed wider apart than shoulder width (Wide Push-Ups), then gradually move the hands closer together so that the smaller muscles (i.e., triceps) are worked last. Starting wide circumvents the problem of fatiguing the triceps prior to fatiguing the pectorals.

5. Dive Bomber Push-Ups

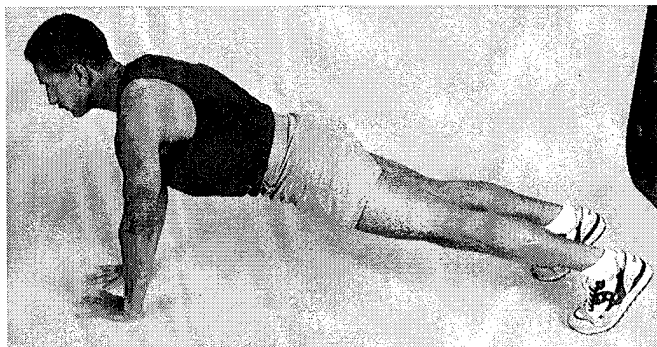


Description: This is a two-count exercise. Start lying on the stomach with the feet spread approximately 3 ft apart, hands on the deck, elbows fully extended, and hips slightly lifted. On the first count, the upper torso sweeps down toward the deck between and through the hands while bending the elbows. The resting position is the same as the down position of a basic push-up. On the second count, the upper torso sweeps back and up while the elbows extend to return to the starting position.

Type of Exercise: Conditioning exercise for the forearms, chest, anterior deltoids, and triceps.

Recommendation: Keep.

6. Triceps Push-Ups

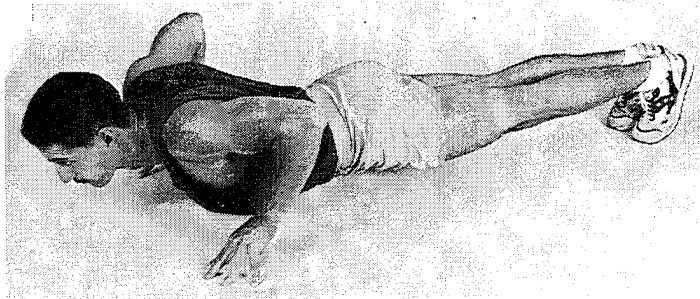


Description: This is a two-count exercise. Begin by lying on the stomach, with feet and hands on the deck, fingers spread, thumb and index fingers on both hands almost touching each other, elbows extended, and body straight. On the first count, bend the elbows at least 90° using the arms to support body weight. On the second count, return to the starting position.

Type of Exercise: Conditioning exercise incorporating the triceps muscles in addition to muscle groups used in regular push-ups.

Recommendation: Keep.

7. Finger-Tip Push-Ups



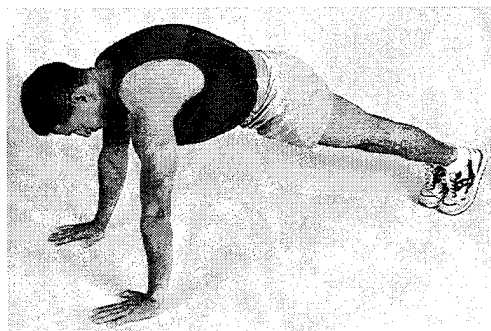
Description: Perform the same as a regular push-up, but support the weight on the fingertips.

Type of Exercise: Conditioning exercise which incorporates the forearm muscles in addition to those muscle groups used in regular push-ups.

Recommendation: Add.

Discussion: This is a good exercise to build forearm and grip strength which is important in the operational setting.

8. Push-Ups With a Plus



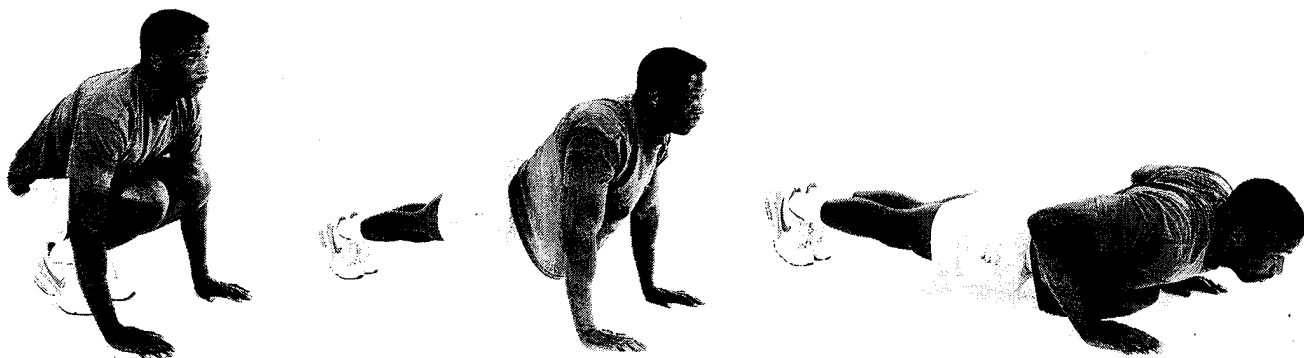
Description: This is a four-count exercise starting from the same position a regular push-up. On the first count, bend the elbows and lower the chest toward the deck (a push-up). On the second count, extend the elbows to the starting position. On the third count, extend the shoulders by engaging the muscles in the upper back to push the shoulder forward. On the fourth count, return to the starting position.

Type of Exercise: Conditioning exercise which engages the posterior shoulder and scapularis muscles.

Recommendation: Add.

Discussion: This is a good conditioning exercise for the upper back muscles.

9. Eight-Count Body Builders

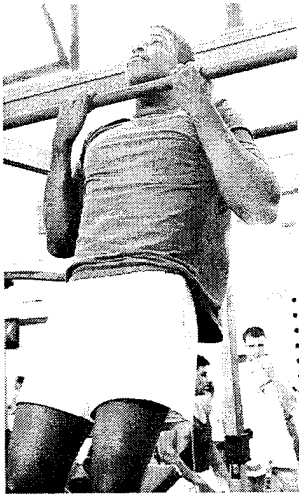


Description: This is an eight-count exercise that starts from a standing position. On the first count, bend the legs and place the hands on deck. On the second count, extend both the legs back supporting the body weight with the extended arms (starting position for a push-up). On the third count, bend the elbows, lowering the chest toward the deck (a push-up). On the fourth count, extend the arms. On the fifth count, separate the legs while keeping the arms extended. On the sixth count, bring the legs back together as they were on the fourth count. On the seventh count, flex the legs and bring them back to the first-count position. On the eighth count, return to the starting position.

Type of Exercise: Conditioning exercise for chest and leg muscles.

Recommendation: Keep.

10. Chin-Ups



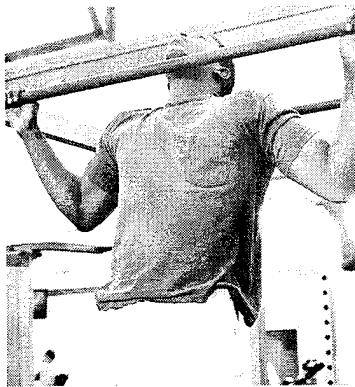
Description: This is a two-count exercise beginning at a dead hang from the horizontal bar with arms shoulder-width apart and palms facing inward. Pull the body up on the first count until the chin touches the top of the bar. Return to the starting position on the second count. No kicking or kip-up allowed.

Type of Exercise: Conditioning exercise which incorporates back and biceps muscles.

Recommendation: Keep.

Discussion: The panel discussed at length the importance of back and grip strength in the operational setting. The consensus was that chin-ups are an important exercise for developing back strength, while pull-ups are a better exercise for developing grip strength.

11. Pull-Ups (Wide, Standard, Narrow, Behind the Neck, Interlocking)



Wide



Standard



Narrow



Behind the Neck



Interlocking

Description: This is a two-count exercise beginning at a dead hang from a horizontal bar with arms shoulder-width apart and palms facing outward. Pull the body up on the first count until the chin touches the top of the bar. Return to the starting position on the second count. No kicking or kip-up allowed.

Type of Exercise: Conditioning exercise which incorporates all the muscles of the back and forearm.

Recommendation: Keep.

Discussion: Pull-ups are especially good for developing grip strength which is important in the operational setting. Adding athletic tape to the bar for a more open-handed grip was highly recommended. Many athletes find that they can not transfer the strength they develop in the weight room to improvements in performance in the field because a lot of the gripping they do is with a more open hand. One panel member gave an example of a judo athlete in Canada who weighed about 110 pounds and could do five pull-ups. Her trainer placed her on a program of five sets of five reps of pull-ups, twice a week for 6 weeks. Every workout, she added a piece of athletic tape so that she was gripping more and more with an open hand. After 6 weeks, she was doing five

pull-ups with 45 pounds strapped to her waist. A suggestion was made to provide varying thicknesses of pull-up bars to help develop grip strength.

Another suggestion for developing grip strength was to hold something (like a rubber ball) in your hand while running, squeezing and releasing the ball repeatedly.

12. Incline Pull-Ups



Description: This exercise is basically a pull-up at an angle and requires a low bar (i.e., a dip bar). While lying or sitting on the ground (depending on how low the bar is), grab the bar with both hands and pull the upper body toward the bar at a 45° angle. Emphasis should be placed on pulling the shoulder blades together during the movement.

Type of Exercise: Conditioning exercise which incorporates the posterior shoulder and triceps muscles.

Recommendation: Add.

Discussion: This exercise was added to balance out the extensive number of push-up exercises.

13. Dips



Description: This exercise requires the use of parallel bars. Supporting body weight, flex and extend the arms.

Type of Exercise: Muscle endurance and strength for the triceps, back, and to some extent, chest and shoulder muscles.

Recommendation: Keep.

Discussion: When gripping the bar, keep the thumb wrapped around it to avoid slipping between bars.

14. Sit-Ups/Flutter Kicks (All)

Sit-ups generated the most lengthy panel discussion of all the exercises. The consensus was that many calisthenics mistakenly thought to be abdominal exercises are actually exercises for the hip flexors (see Appendix A). "Abdominal exercises" which lift the mid to lower back off the floor (e.g., Hand to Toes), are actually working the hip flexors. Exercises in which both legs are elevated 6 inches off the ground (e.g., Hello Darlings, Flutter Kicks, Leg Levers, Inboard Outboards) work the hip flexors. Although both hip flexor and abdominal strength is necessary for operational performance, overdeveloped hip flexors play a significant role in the development of lower back problems. Overdeveloped hip flexors not only change the curvature of the spine but also place stress on the front portion of the vertebral discs. The panel concluded that the majority of low-back pain in the NSW community is likely due to hypermobile segments at the L4-L5 and L5-S1 level of the spine, plus S1 joint dysfunctions caused by an overabundance of hip flexor calisthenics.

Hip flexor strength is necessary, but should be balanced with equally developed strength in the hip extensors (muscles that move the legs away from the chest). A balanced workout that incorporates the abdominals, hip flexors, and hip extensors is the goal. Therefore, it is important to identify which exercises are appropriate for which muscle group and include all three in a physical training (PT) program.

Proper technique is essential to avoid placing undue stress on the lower back, especially when performing those exercises while lying on the back (supine) with both legs elevated off the deck (e.g., Hip Rollers, Flutter Kicks, Good Morning Darlings). To decrease the mechanical stress on the lower back and muscles during these types of exercises, the panel made the following general recommendations:

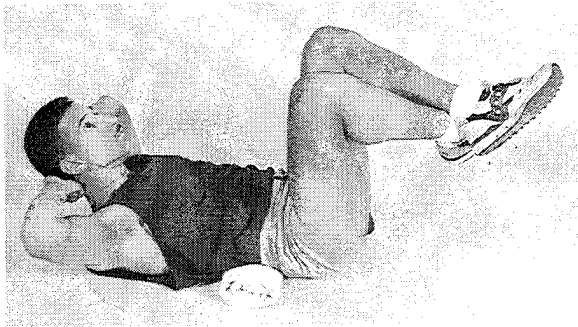
- (1) Keeping one foot on the deck helps minimize the stress placed on the lower back and spine. Many exercises that require both legs to be off the deck simultaneously can be modified so that one foot is constantly on the deck supporting the lower back.
- (2) Placing the fist under the lower part of the buttocks helps to keep the spine in a neutral position.
- (3) Lifting the head and slightly rolling the shoulder also helps maintain the position of the spine.
- (4) Hip flexor exercises should only be performed twice a week.

Abdominal strength is best developed by exercises performed within the anatomical range of motion. This is best accomplished by placing a roll (i.e., rolled-up towel) in the small of the back so that the exercise is performed from a slightly extended to a slightly flexed position. The goal is to exercise with some curve in the lumbar spine as opposed to a flat back.

When performing sit-ups, the hands can be placed at the sides, across the chest, behind the head, or clasped together above the head. If placed behind the head, care should be taken not to force the neck to flex. Keeping the eyes focused on the ceiling helps to prevent neck strain while isolating the abdominals. Concentration on using the abdominals through the whole range of movement is essential. This exercise, when done correctly, is actually a **small, slow, concentrated** movement. Once your shoulder blades come off the floor, you've done about all there is to do

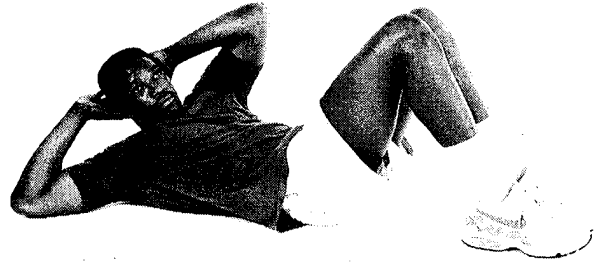
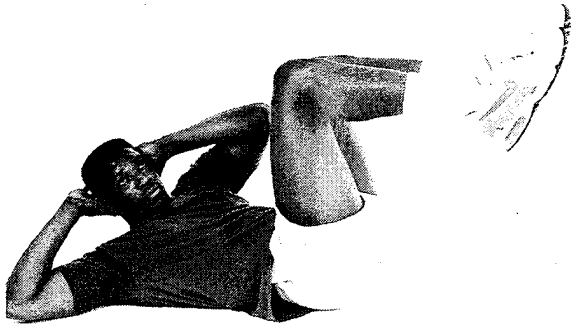
with the abdominals. The focus should be on the quality of sit-ups, not the quantity. One panel member suggested that the cadence be slowed to allow time to perform a proper sit-up. General panel recommendations regarding sit-ups are:

- (1) Identify those exercises which are true abdominal exercises versus those which work the hip flexors.
- (2) Decrease the number of hip flexor exercises performed to two sessions per week with fewer repetitions per session.
- (3) Increase the number of true abdominal exercises (e.g., Crunches, Elbow to Knee/Cross Overs, Hip Rollers, Side Flex)
- (4) Add hip extensor exercises (e.g., Prone Back Extension, The Superman, Donkey Kicks)
- (5) Focus on proper technique.



Recommended Sit-Up

15. Elbow to Knee/Cross Overs - Legs Bent



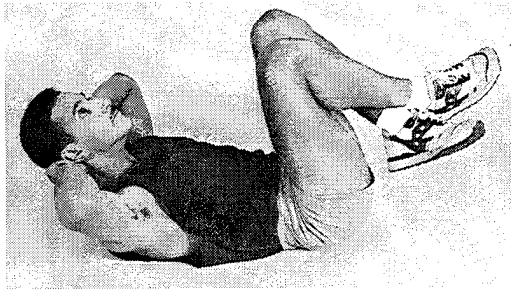
Description: Begin by lying on the back with the hands clasped behind the head. Legs can be either bent at the knees with feet on the deck or bent with knees toward the chest (feet elevated from the deck), or with one leg crossed over the knee of the other leg. Slowly lift and twist the torso bringing one shoulder toward the knee of the opposite leg. Return to starting position. Perform exercise on both sides.

Type of Exercise: Conditioning exercise for the abdominals and obliques.

Recommendation: Keep.

Discussion: Keeping the knees bent and the feet either on the deck or elevated protects the lower back.

16. Crunches

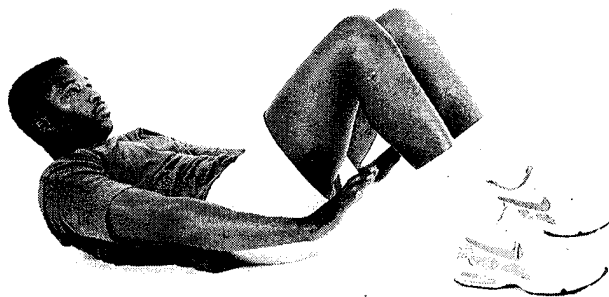


Description: Lying on the back with legs bent and elevated off the deck, either place the hands behind the neck or cross the arms on the chest. Lift the upper torso 10 to 12 inches off the ground, then return to the starting position.

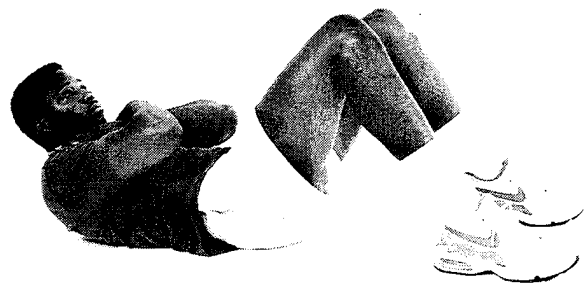
Type of Exercise: Conditioning exercise for the abdominals.

Recommendation: Keep.

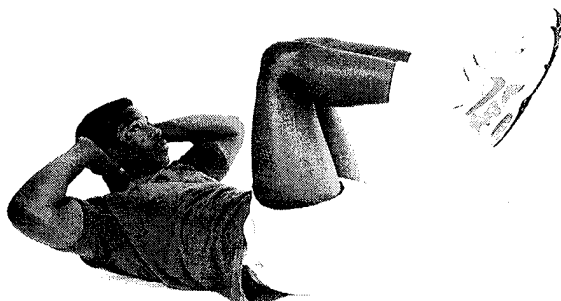
Discussion: There are many variations to this exercise. For example, the legs may be bent with feet on the deck, bent with knees towards the chest and feet elevated, or extended vertically (as in Vee-Ups). The arms also may be placed in several positions including alongside the body (easiest), across the chest, hands behind the head, or hands clasped above the head (most difficult).



Easiest



Easy



Difficult



Most Difficult

17. Hip Rollers

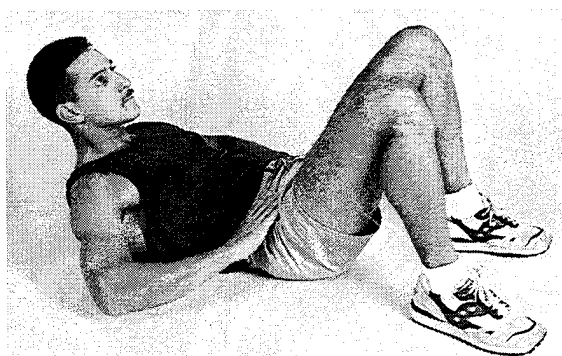


Description: Lying on back with legs bent and elevated off deck, slowly bring both knees down together on one side until the lower back begins to lift off the deck. Bring the knees back to the starting position, then repeat on the other side.

Type of Exercise: Conditioning exercise for the abdominals.

Recommendation: Keep.

18. Stomach Pump-Ups



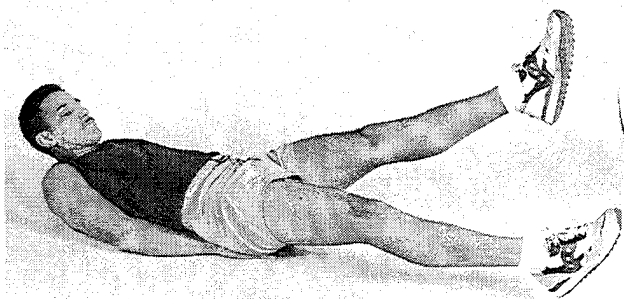
Description: Begin by lying on the back with knees bent, feet on the deck, and hands on hips. Then, lift and lower the upper torso.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Keep. Limit use of this exercise.

Discussion: Keeping the mid to low back on the ground prevents engagement of the hip flexors.

19. Flutter Kicks



Description: This is a four-count exercise. Start by lying on the back, with hands under the hips, legs extended, and feet together, 6 inches above the deck. On the first count, lift the right leg 1 1/2 feet, keeping the leg straight. On the second count, lift the left leg to the same position while returning the right leg to the starting position. On the third count, bring the right leg back up, while returning the left leg to starting position. On the fourth count, shift legs once more.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38.

20. Good Morning Darlings



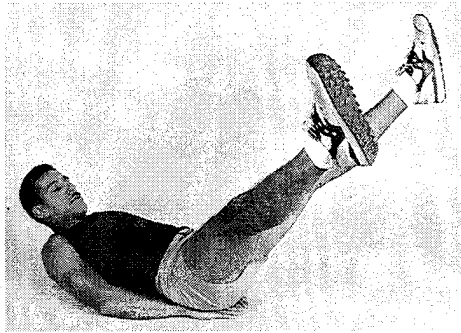
Description: This is a four-count exercise. Start by lying on the back, with hands under the hips, legs extended, and feet together, 6 inches above the deck. On the first count, spread the legs 2 to 3 feet apart. On the second count, bring the legs back together. The third count repeats the first position. On the fourth count, the legs come back together.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: This exercise has potential for injury to the discs and lower back. For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38.

21. Inboard/Outboards



Description: Start lying on the back with hands under hips, feet about 3 feet apart, 2 feet above the deck. Bring feet out, around, up, in, and down (inboard circles) while making small circles in the air. Change the direction of the circles for outboards.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: This exercise has potential for injury to the discs and lower back. For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38.

22. Leg Levers



Description: Lying on the back with arms at the sides, slowly lift the legs approximately 2 feet off deck and lower them down again.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

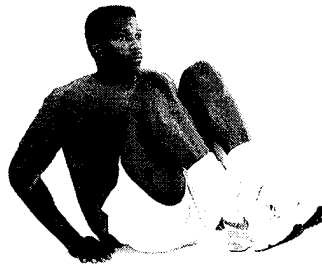
Recommendation: Modify. Keep one foot on the deck, limit use, and maintain proper technique.

Discussion: This exercise has potential for injury to the discs and lower back. For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38.

23. Knee Benders (Supine and Seated)



Supine



Seated

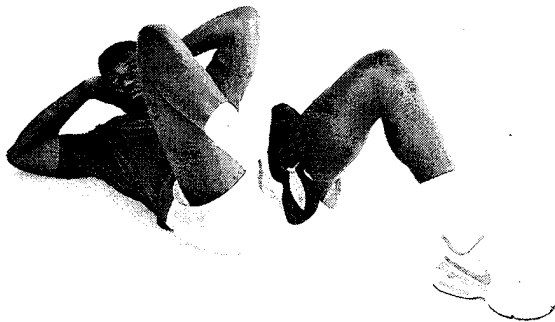
Description: Begin lying on the back with arms at the sides. Bring both legs 6 inches off the deck, bend at the knees, bringing the legs towards the chest. Then, straighten knees and lower the legs down again. As an alternative, perform the same leg movements from a seated position.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: This exercise has the potential for injury to the discs and lower back. For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38.

Knee benders can be modified to decrease the amount of hip flexor work and increase the amount of abdominal work performed. Begin with hands clasped behind the head, one leg bent with the foot on the deck and the other leg extended. Bend the extended leg and bring it towards the chest while lifting the shoulders off the deck. Return to starting position. Another variation (pictured below) specifically engages the obliques. Begin as previously described with one leg bent and the other extended. While bending the extended leg, lift the opposite shoulder towards the knee as it is brought towards the chest. Return to starting position.

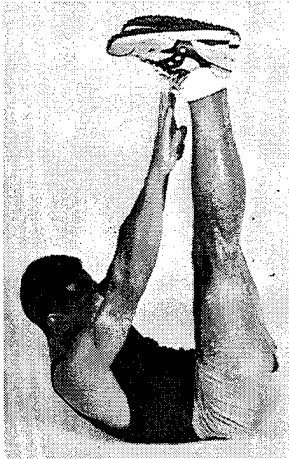


Recommended Modification



Recommended Modification

24. Vee-Ups



Description: Lying on the back with arms above the head, bring the legs, arms, and torso toward the midline.

Type of Exercise: Conditioning exercise for the abdominals and hip flexors.

Recommendation: Modify. Keep the legs vertical throughout the exercise.

Discussion: This exercise has the potential for injury to the discs and lower back. It was recommended to perform this exercise slowly and hold it longer at the peak. The legs should be kept in a vertical position throughout the exercise. One can then touch the toes from a lying position or place the hands behind the head and slowly bring the chest up. This modification would take out the hip flexor work and make Vee-Ups a safe abdominal exercise.

25. Helen Kellers/Nuclear Sit-Ups



Hellen Kellers



Nuclear Sit-Ups

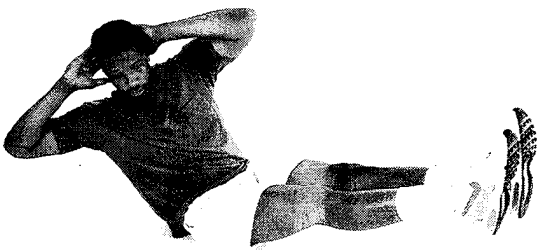
Description: Begin from a sitting position. Raise both feet off the deck while leaning slightly back and extending the arms. Lift one leg 6 to 12 inches, then bring the opposite arm down and toward the raised leg. Switch arms and legs in a scissor-type movement. This exercise is also done with the hands behind the head (Nuclear Sit-Ups).

Type of Exercise: Conditioning exercise for abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: This exercise has the potential for injury to the discs and lower back. Make sure the pelvis remains stable in a neutral position. When the pelvis drops back, this becomes even more of a hip flexor exercise.

26. Jane Fondas



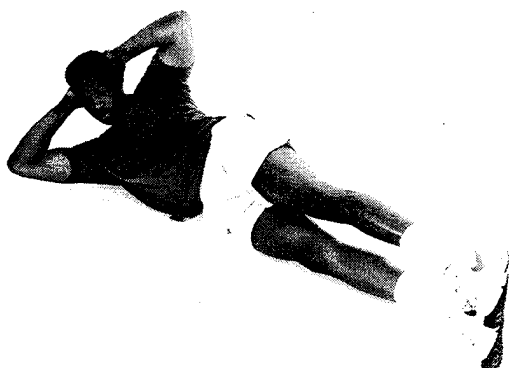
Description: Begin from a seated position with hands clasped behind the head, hips slightly rolled to the side, and legs extended. Raise both legs off the deck toward the chest and then lower them back down.

Type of Exercise: Conditioning exercise for abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: This exercise has potential for injury to the discs and lower back. For a full discussion of panel recommendations, please refer to the Sit-Ups/Flutter Kicks section on page 38. When performing this exercise, keep one foot on the deck.

27. Side Flex



Description: Begin lying on the side with legs extended and hands clasped behind the head. Raise the torso off the deck and lower back down.

Type of Exercise: Conditioning exercise for abdominals (obliques).

Recommendation: Keep.

Discussion: The torso does not need to be elevated more than a few inches off the deck.

28. Sitting Flutter Kicks



Description: This exercise is the Flutter Kick performed from a seated position.

Type of Exercise: Conditioning exercise for abdominals and hip flexors.

Recommendation: Modify. Limit use and maintain proper technique.

Discussion: Avoid hyperextension of the back and keep the pelvis stable.

29. Prone Flutter Kicks



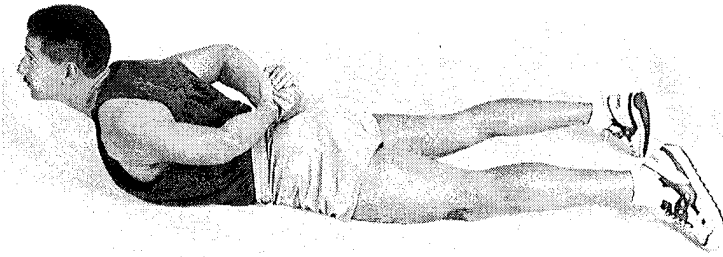
Description: This exercise is the Flutter Kick performed lying on stomach.

Type of Exercise: Conditioning exercise for the back and hip extensors.

Recommendation: Keep.

Discussion: Avoid hyperextension of the back. Exercises that work the hip extensors were highly recommended because they help balance out the hip flexor conditioning.

30. Prone Back Extension



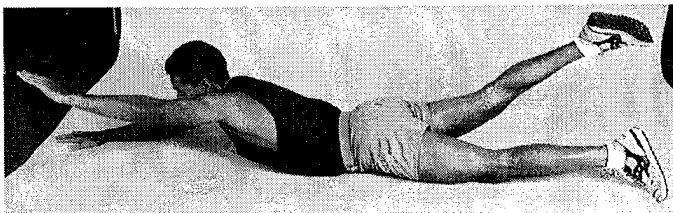
Description: Lying face down on deck, hands clasped behind the back, lift the upper torso off the deck, hold, and return to starting position.

Type of Exercise: Conditioning exercise for the back and hip extensors.

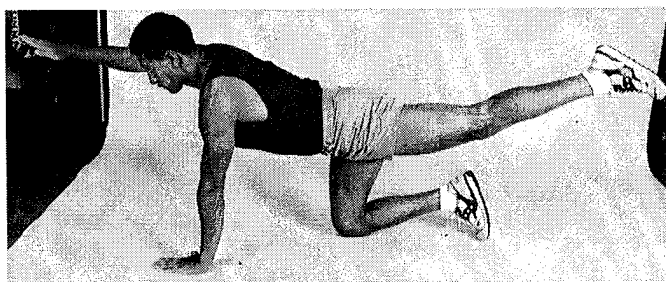
Recommendation: Keep.

Discussion: Avoid hyperextension of the back. Placement of the hands alters the difficulty; behind the back is the easiest, behind the head is more difficult, straight out in front is the most difficult.

31. The Superman (Prone and Kneeling)



Prone Superman



Kneeling Superman

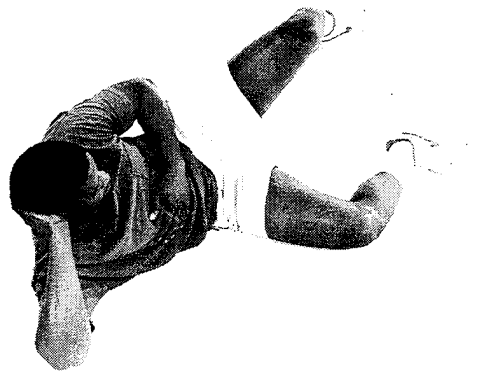
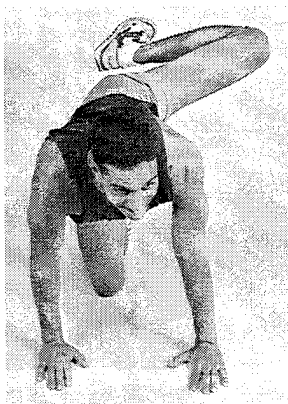
Description: This exercise can be performed either lying on the stomach or on the hands and knees. The opposite arm and leg (i.e., right arm, left leg) should be lifted and held for 3 to 5 seconds, then slowly lowered. The same movements should then be made with the other arm and opposite leg.

Type of Exercise: Conditioning exercise for back muscles and hip extensors.

Recommendation: Add.

Discussion: This exercise helps develop balanced strength between the hip flexors and hip extensors. It is very safe, and although it may look easy, it can burn after a while. The Superman can be made more difficult by adding weights to the arms and legs. To avoid hyperextension of the back, the leg should not be raised higher than the hip when in the kneeling position.

32. Dirty Dogs



Description: On hands and knees, keeping the legs bent, lift one leg, knee pointing outward, to the end of the range of motion. Repeat this movement until leg muscles burn, then switch to the other leg.

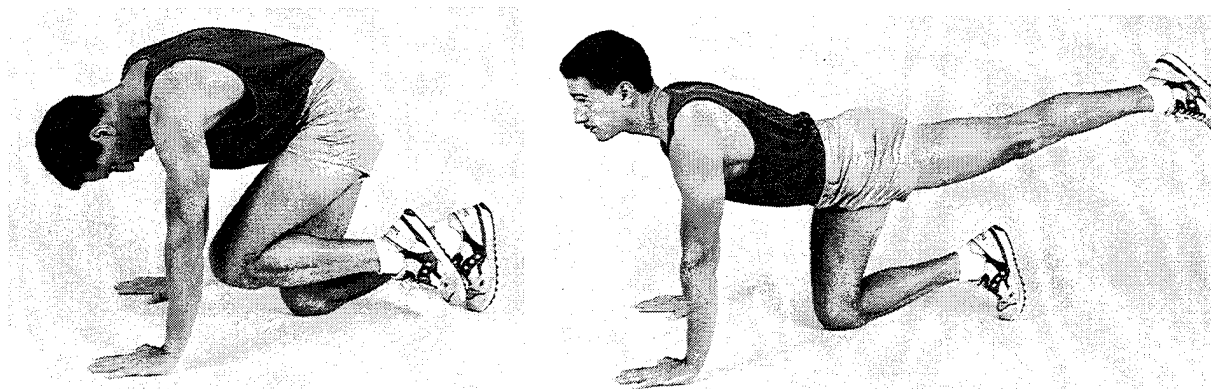
This exercise may also be done lying on one side. Bend legs at a 90° angle from the torso. Lift and lower the top leg.

Type of Exercise: Conditioning exercise for the hip/thigh abductors.

Recommendation: Keep.

Discussion: This strengthening exercise for the hip/thigh abductors was recommended because the NSW PT program currently contains no hip abductor exercises. Additional exercises for the hip/thigh adductors (e.g., Burt Reynolds) were also suggested for a balanced workout.

33. Donkey Kicks



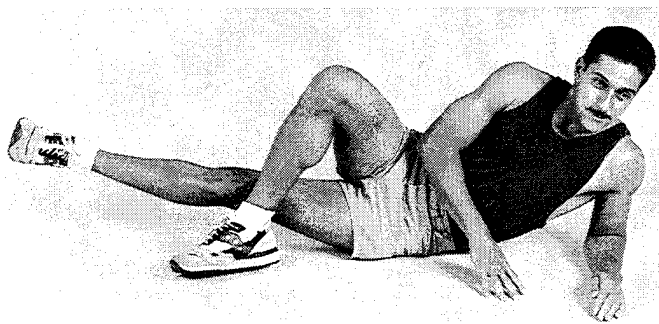
Description: On hands and knees, extend one leg out and behind, then bring it back. Repeat this movement using the same leg until a burn is felt in the hips and lower back. The opposite leg should then be exercised.

Type of Exercise: Conditioning exercise for the hip extensors.

Recommendation: Add.

Discussion: This exercise may be combined with Dirty Dogs. The same leg would be lifted to the side and returned, then extended behind and returned. To avoid hyperextension of the back, the leg should not be raised higher than the hip.

34. Burt Reynolds



Description: Lying on the side in a straight line, bend the top leg and place it in front of the knee of the opposite leg. Raise and lower the straight leg approximately 8 inches off the deck until fatigued. This exercise should be felt in the inner thigh.

Type of Exercise: Conditioning exercise for the hip adductors.

Recommendation: Add.

Discussion: This exercise is beneficial for rock climbing.

35. Plyometrics



Bunny Hops



Side to Sides



Lunges

Description: Plyometrics is a general exercise category consisting of a variety of exercises including Bunny Hops, Lunges, and Leap Frogs.

Type of Exercise: Conditioning exercises for all hip and leg muscles.

Recommendation: Keep. These exercises are major components of an ideal conditioning program.

Discussion: Plyometrics develop muscle strength and power both concentrically (contraction of the muscle while it shortens) and eccentrically (contraction of the muscle while it lengthens). Plyometrics also improve proprioception (peripheral sensory feedback, balance) which can both prevent and rehabilitate injuries.

Plyometrics should be performed only after the body is warmed up.

As with other exercises, attention should be paid to proper technique. For example, when performing lunges, the knee angle should not exceed 90°. Any movement beyond this angle places undue stress on cartilage and ligaments. Keeping the knee over and in line with the big toe improves technique. The step should be straight out, not to the side.

When performing plyometrics, the number of repetitions should be limited to avoid deterioration of technique. When technique begins to fail, switch to a different exercise (e.g., from Lunges to Bunny Hops or Side to Side). Slowing the count or cadence can also help offset fatigue.

36. One-Legged Squat



Description: Using one leg to support the body weight, bend the leg until the thigh is almost parallel to the ground and return to starting position. Repeat using the other leg.

Type of Exercise: Conditioning exercise for the hip and thigh muscles.

Recommendation: Add.

Discussion: This exercise is good when equipment and/or weights are unavailable. Squat exercises should be performed with the upper portion of the legs parallel to the ground. Anything lower places excessive stress on the knee. This exercise also helps improve proprioception (peripheral sensory feedback, balance).

B. CONDITIONING EXERCISE REVIEW (ELIMINATE)

1. Hand to Toe Sit-Ups



Description: Begin lying on the back with arms stretched above the head. Raise the torso off the deck and bring arms up and over to touch the toes.

Type of Exercise: Conditioning exercise for the hip flexors.

Recommendation: Eliminate.

Discussion: Hand to Toe Sit-Ups place mechanical stress on the back and do not exercise the abdominals. Elbow to knee exercises with legs bent are preferred.

Appendix A - Anatomical Terms and Illustrations

ANATOMICAL TERMS

Common Term for Muscle Group	Muscles	Function
Chest Muscles	<i>Pectoralis major*</i> , <i>pectoralis minor*</i> , <i>serratus anterior</i> , <i>subclavius</i>	Flexion, adduction, extension, and rotations of shoulder girdle (pushing, bench pressing)
Abdominals	<i>Transverse abdominal*</i> , <i>rectus femoris</i> , <i>external oblique</i> , <i>internal oblique</i> , <i>psoas major</i>	Spinal flexion, lateral flexion, and rotation of the trunk
Back Extensors	<i>Erector spinae*</i> (<i>iliocostalis</i> , <i>longissimus</i> , <i>spinalis</i>)	Move vertebral column backward
Hip Flexors	<i>Iliopsoas*</i> , <i>rectus femoris*</i> , <i>sartorius</i> , <i>pectineus</i> , <i>tensor fascia latae</i> , <i>adductor muscles</i> , <i>anterior part of gluteus medius</i>	Move leg forward and toward the chest at the hip joint
Hip Extensors	<i>Gluteus maximus*</i> , <i>semitendinosus</i> , <i>semimembranosus*</i> , <i>biceps femoris*</i> ,	Extend the leg backward at the hip joint
Hip/Thigh Adductors	<i>Adductor magnus*</i> , <i>adductor longus*</i> , <i>adductor brevis*</i> , <i>pectineus</i> , <i>gracilis</i>	Move leg toward the midline
Hip/Thigh Abductors	<i>Gluteus medius*</i> , <i>gluteus minimus*</i> , <i>tensor fasciae latae</i> , <i>sartorius</i>	Move leg away from the midline
Knee Flexors	<i>Biceps femoris*</i> , <i>semimembranosus</i> , <i>semitendinosus</i> , <i>gracilis</i>	Flex or bend the legs at the knee joint
Knee Extensors	<i>Quadriceps femoris*</i> , (<i>vastus lateralis*</i> , <i>vastus intermedius*</i> , <i>vastus medialis</i> , <i>rectus femoris</i>), <i>sartorius</i>	Extend the leg forward at the knee joint. The <i>vastus medialis</i> muscle plays an important role in the prevention of overuse injuries of the knee
Calf Muscles	<i>Gastrocnemius</i> , <i>soleus</i>	Extends the foot at the ankle
Tibialis	<i>Tibialis anterior</i> , <i>tibialis posterior</i>	Flexes or extends the foot at the ankle

* Major muscles involved in movement

Figure 1. Anterior Chest

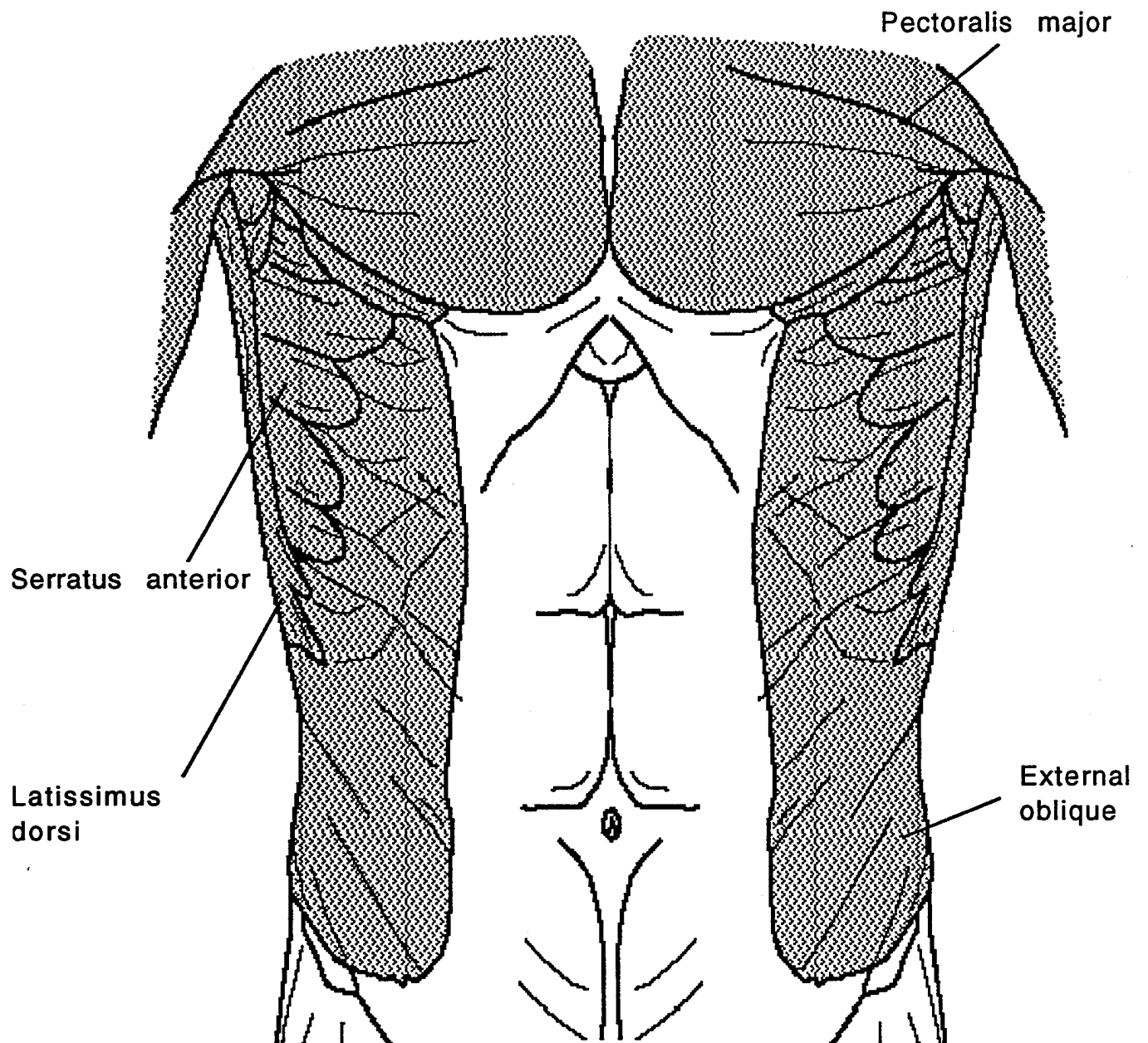


Figure 2. Posterior Back

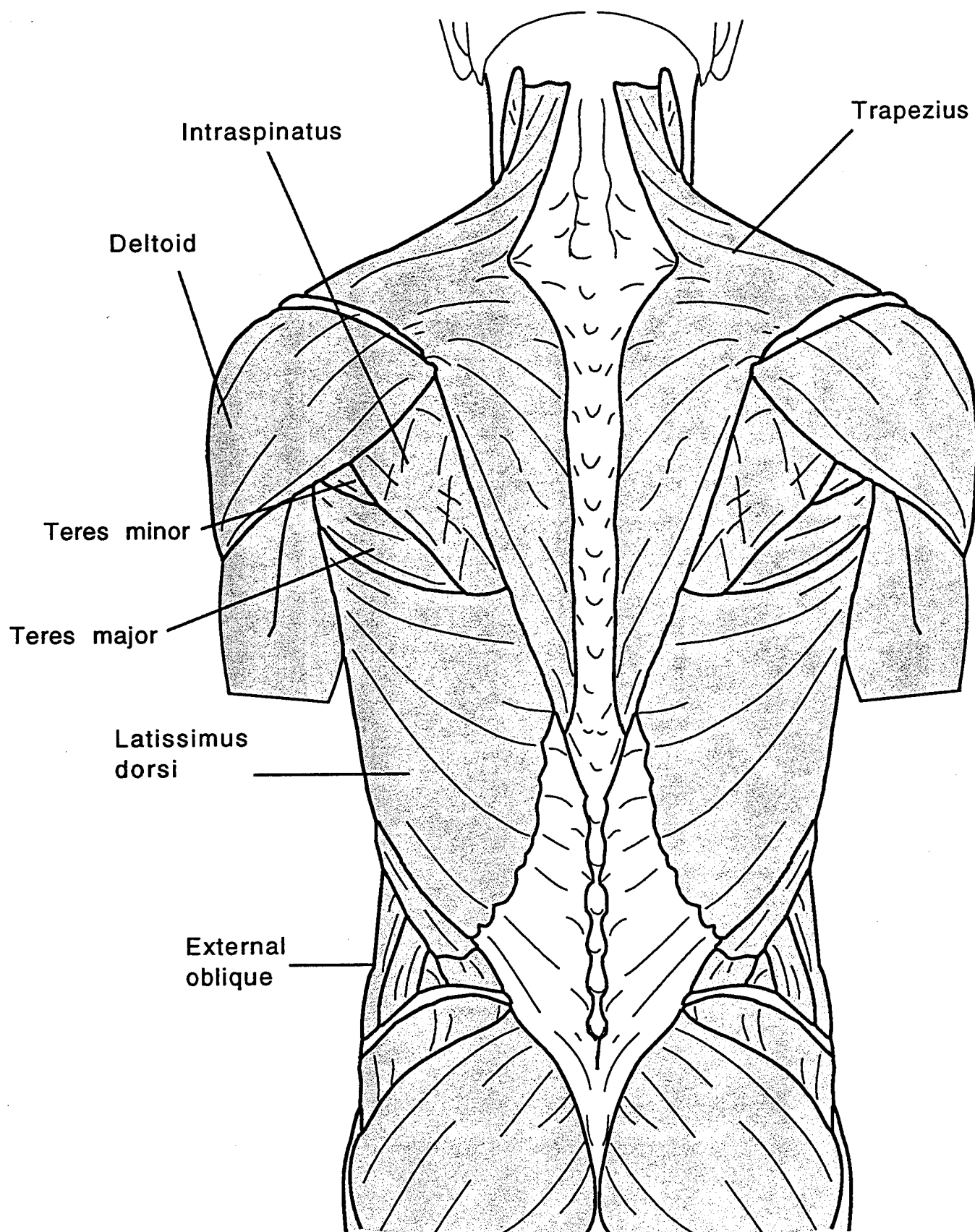


Figure 3. Anterior Leg

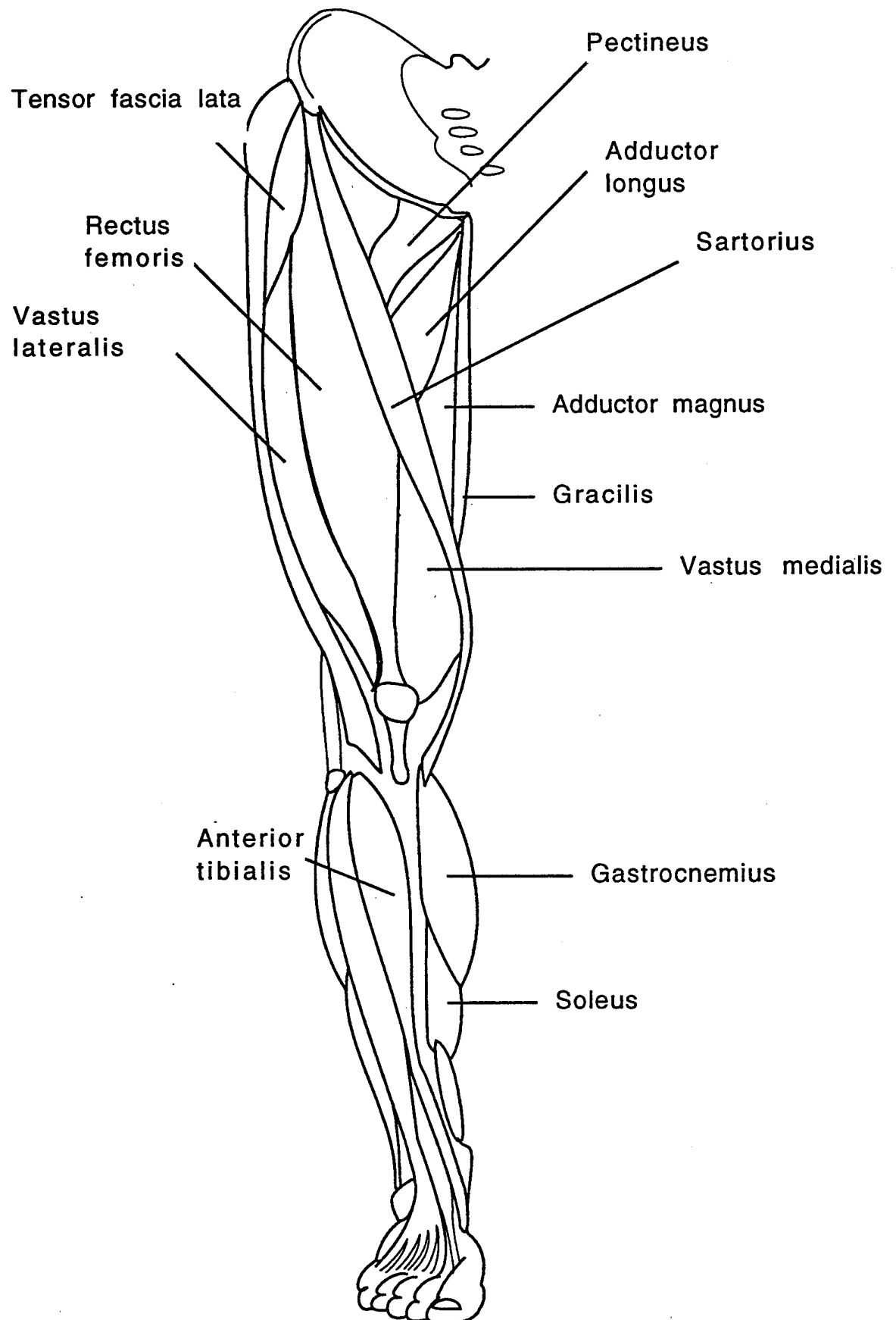


Figure 4. Posterior Leg

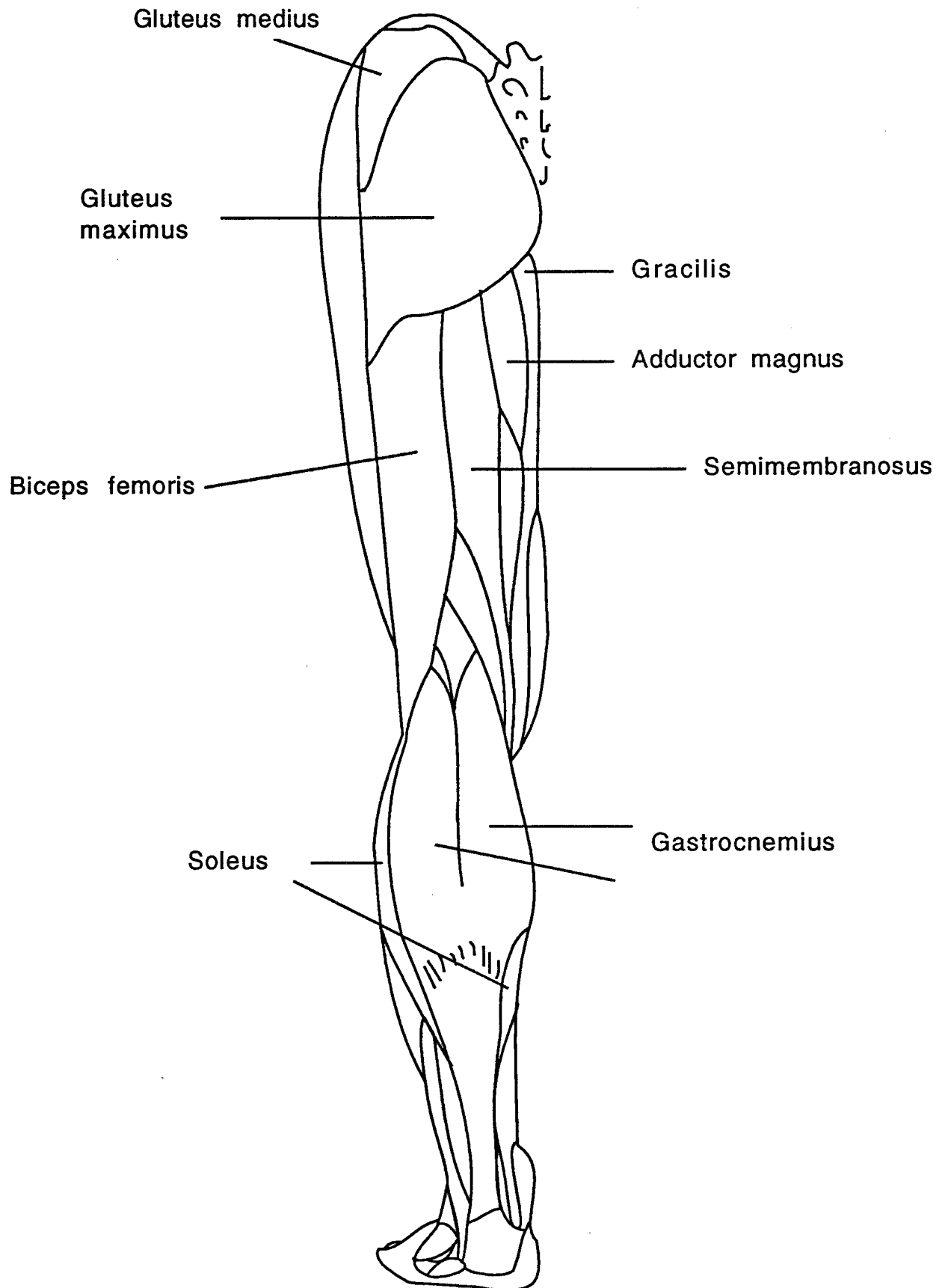


Figure 5. Back Flexion and Extension

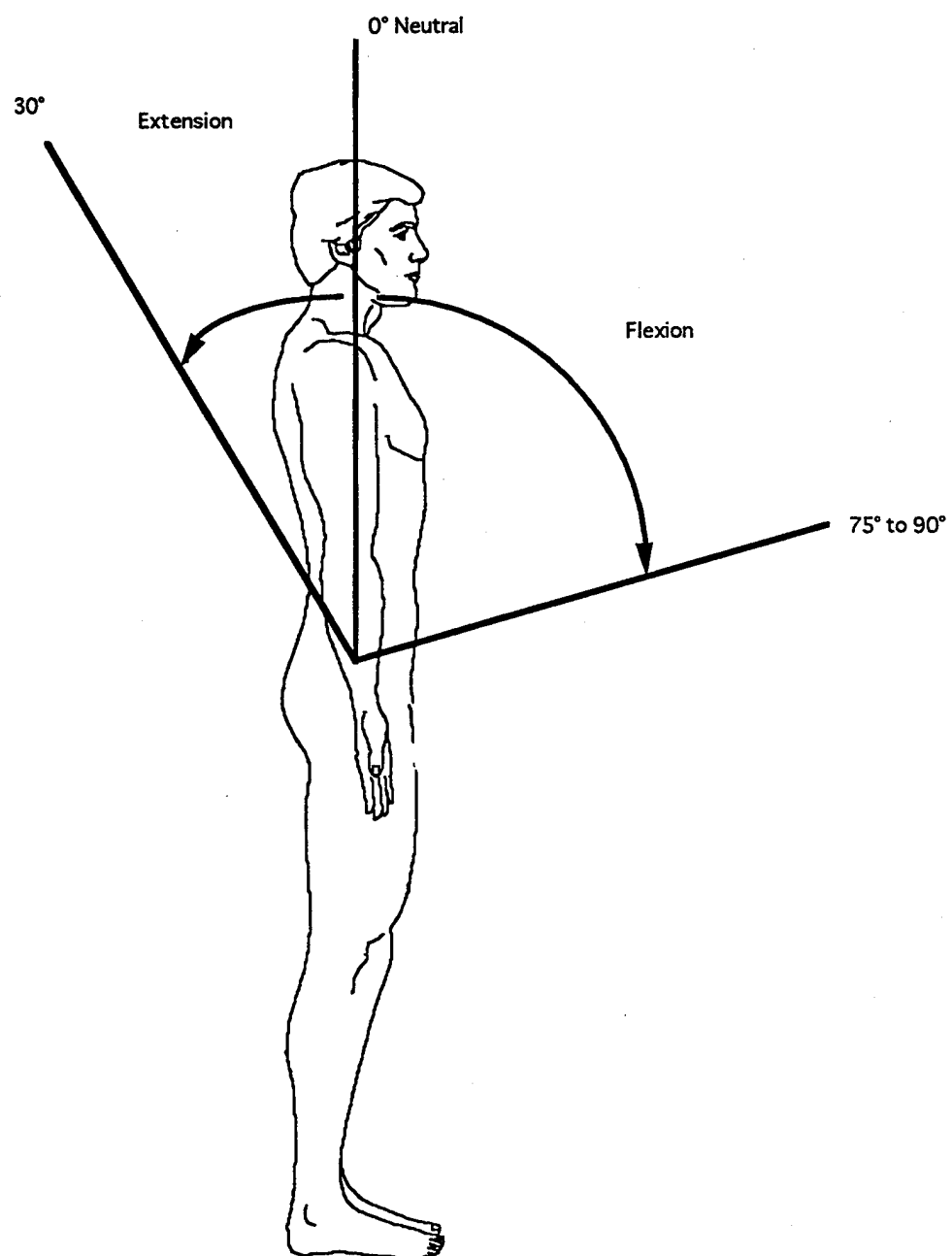


Figure 6. Hip Flexion and Extension

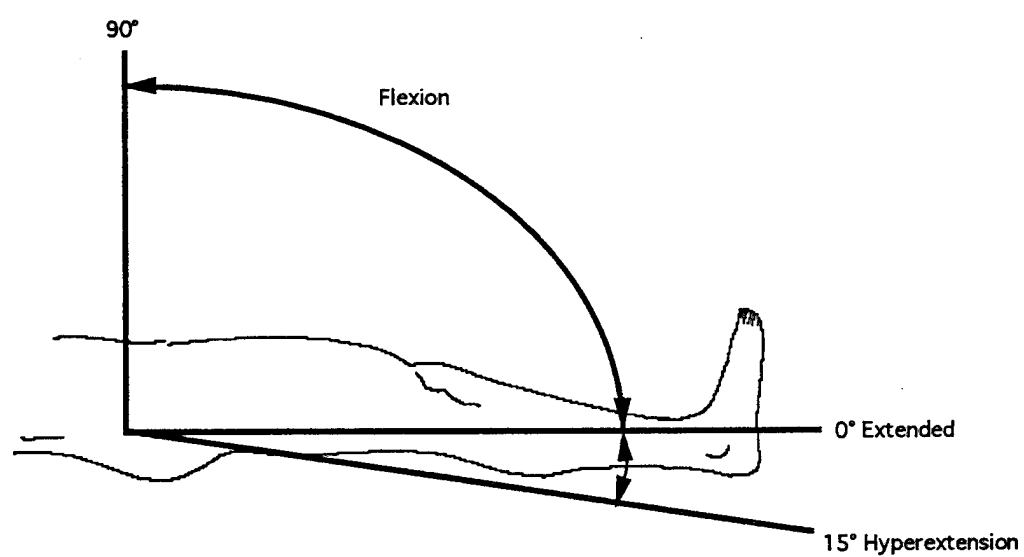


Figure 7. Hip/Thigh Abduction and Adduction

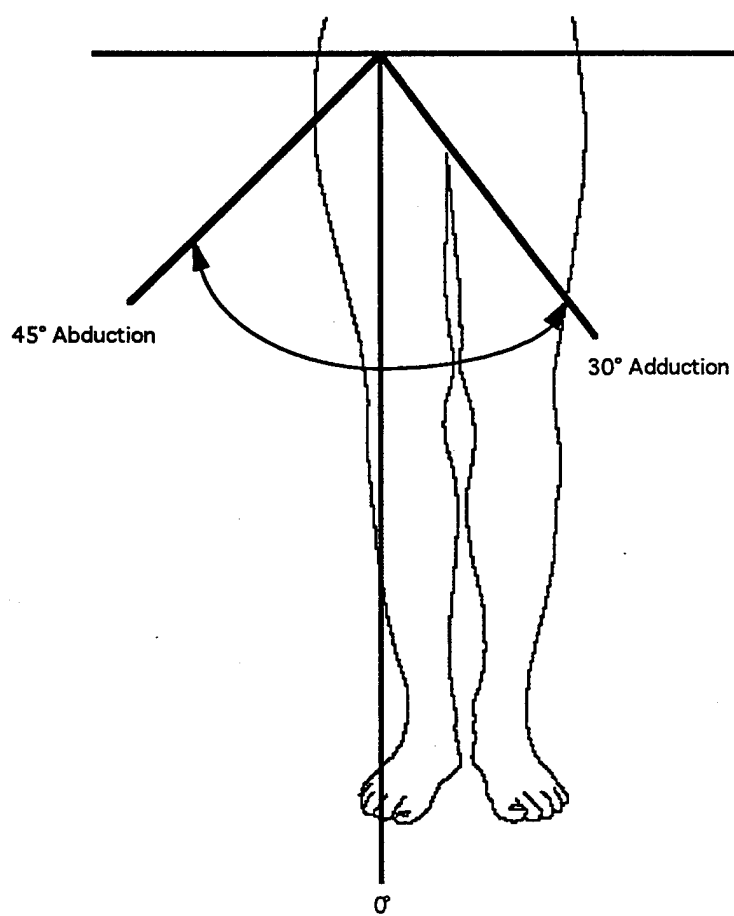
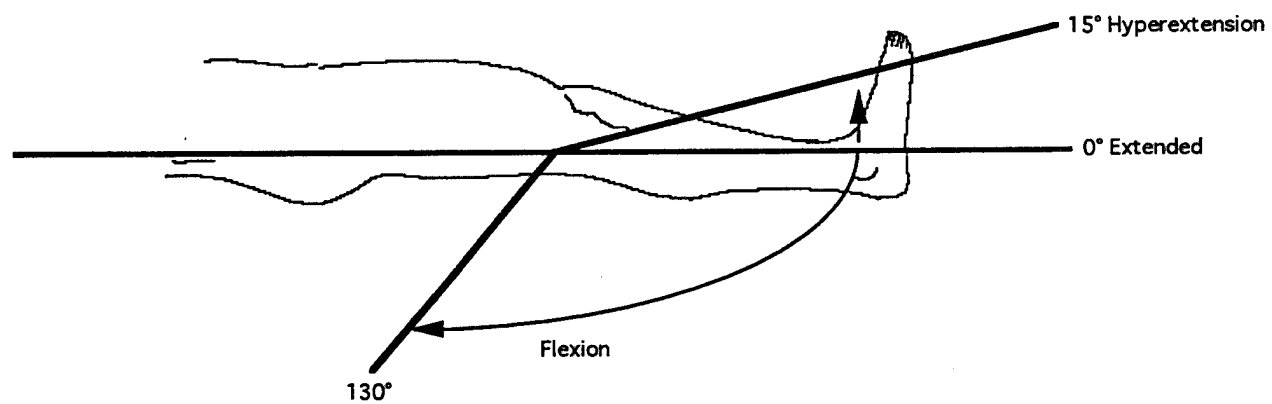


Figure 8. Knee Flexion and Extension



REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE October 1995		3. REPORT TYPE AND DATE COVERED Final; May 1994-Oct. 1995
4. TITLE AND SUBTITLE Expert Panel Review of Naval Special Warfare Calisthenics: Sports Medicine Conference Summary		5. FUNDING NUMBERS Program Element: 60407N Work Unit Number 407BB.001-6305		
6. AUTHOR(S) Meyer, Lisa T., Smith, Tracy Sopchick, Friedlander, A.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Health Research Center P. O. Box 85122 San Diego, CA 92186-5122		8. PERFORMING ORGANIZATION Technical Document 95-5E		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Medical Research and Development Command National Naval Medical Center Building 1, Tower 2 Bethesda, MD 20889-5044		10. SPONSORING/MONITORING AGENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) NSW commands adhere to intensive physical training programs placing them at high risk for musculoskeletal injury. The objective of this research was to review the NSW calisthenic program and make recommendations to improve the safety and efficacy of the exercises. A panel of experts was assembled that included sports medicine specialists (physicians, physical therapists, biomechanists, exercise physiologists, and certified athletic trainers) from the United States Olympic Committee, San Diego State University, United States Air Force Academy, Naval Medical Center San Diego, Naval Hospital Camp Pendleton, San Diego Children's Hospital, and Applied Futuristics. The panel reviewed the calisthenics and made a decision to eliminate, keep, or modify each exercise. The panel also recommended calisthenics to be added to the program. Fifty-six exercises were reviewed. The panel recommended that 8 exercises be eliminated, 31 be kept, 17 be modified, and 16 be added. It was concluded that NSW personnel could benefit from minor modifications to their existing physical training program. Guidelines for a complete physical training program are needed.				
14. SUBJECT TERMS Calisthenics; conditioning; special forces; exercise			15. NUMBER OF PAGES 70	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	