

CHAPTER 11: PHYSICAL DEVELOPMENT

REGARDING THE VOCABULARY:

This chapter uses several specific terms and phrases in describing the physical actions, processes and consequences of the exercises below. As these terms are not specific to archery, nor are they necessarily relevant to the other chapters in this manual, a glossary has been provided at the end of this chapter as a reference for these particular terms.

INTRODUCTION:

In this chapter warm-up techniques and exercises to develop an archer's physical capacities - cardio-vascular, body control, body balance and strength - are discussed.

Archers are athletes and, as such, they must train much as any other athlete does. To reach the highest levels of performance, this training must be functionally specific and directly related to their own sport discipline, to its technical aspects, and in particular the biomechanical and metabolic needs which are required by the discipline itself.

The objectives determined by the physical preparation must also correspond to the real needs of the novice, taking into consideration factors such as their current fitness level and ability to train.

As a general statement, the archer's requirements can be described as follows:

- Good cardiovascular fitness so the archer can train or compete for extended periods without tiring.
- Accurate control of the vertical posture from the head to the feet.
- Control of the horizontal musculoskeletal components used in the execution of the shot process.
- The ability to maintain the proper body alignment: shoulders directly above the hips and feet. (*)
- Good flexibility and mobility.
- Excellent conditioning of all receptors (sensory perceivers) which allow a high degree of precision and for long periods of time.

(*) See section entitled "The importance of keeping the shoulders and hips directly above the feet" in chapter "6.11.1 Aiming Complementary Knowledge"

A fundamental part of the physical preparation in archery is represented by the three "psychomotor" spheres: motor, emotional and intellectual. Research shows that it is crucial to use a balanced combination of physical and coordination-based training exercises for optimal skill development.

The so called conditional physical qualities (strength, resistance and stamina) must support and improve the archer's efficiency in terms of duration or precision with respect to the technical action.

Enormous strength and stamina are not necessarily the main goals in improving the athlete's conditioning, but this does not mean that general physical fitness should be neglected. In fact, the athlete's base fitness forms the foundation for the development (sooner or later depending on the methodology) of specific archery skills.

Therefore we can define the archer as an organism that self-regulates with continuous adaptation controls. In other words, the archer can modify his or her actions to adapt to any internal or external changes occurring during the shot process.

Archery is an activity requiring the ability to perceive and interpret incoming information from multiple sources (physical, emotional, intellectual, meteorological, etc.) and react in a coordinated, considered and timely fashion. The incorporation of the bow complicates the reactions required as the archers must take into account the interactions between themselves and the bow as well as the bow/archer unit as a whole.

The ability to react to situations and sensations (sensory or physical) increases as the athlete's skill level improves.

A variety of physical skills and strengths are needed for archery, especially if the training is targeted at young people with

growing bodies and a still-developing neuromotor system.

In addition, varying and alternating training exercises is important to allow continuous and measurable improvements in conditioning and coordination without the risk of developing one muscular pattern while neglecting others.

Equilibrium or balance, another key element in archery, is directly linked to:

- The degree of postural control, coming through the whole proprioceptive system (internal stimuli);
- The quick and effective (postural) adaptations of the oto-vestibular system (*organ in the middle ear that controls body position according to its spatial movements*). This organ senses and then signals the changes needed in order to find the proper posture and muscle engagement required to function well in response to varying external situations;
- The strength to readjust, in a very short period of time, the body's status through proper and specific muscular contractions.

The exercises that develop the ability to maintain or recover good balance need a high level of focus on the part of the novice while the exercise is in progress. This attention has to be mainly directed to the signals coming from the body itself. Developing good balance is a crucial factor in the general evolution of a novice in a sport requiring precision while executing both physical and technical movements through an action.

The proposed exercises for developing, refining and consolidating the ability to maintain and/or recover the equilibrium normally involve all three of the previously listed factors. This means that they are all engaged, simultaneously, to re-create the starting conditions or to achieve the objective of recovering the proper body axis.

These exercises are not an exhaustive list, but a selection suggested as a starting point for a good and balanced training program.

Also the knowledgeable coach should feel free to adapt and change the exercises to best suit the athletes they're working with.

To the lecturer or reader:

If, or when, you have some new and interesting exercises, please send them to the WORLD ARCHERY office for inclusion in these documents.

11.1. WARM-UP

The physical activities shown below are presented under two main groups.

- General physical exercises using common processes and tools as in other sports;
- Specific physical training which involves shooting a bow and arrow.

Although entry level archers use light weight bows, it is a good idea for coaches to include a warm-up routine at the beginning of the session. Aside from creating a good habit; the exercises will also prevent injuries. The following is a suggestion of how the level 1 coach can organize a warm-up session, one of many that could be presented.

This particular example involves several common warm-up components:

- Cardio-vascular exercises;
- Movements of general warm-up;
- Stretching;
- Warm-up through effort producing movements – an introduction to strengthening;
- Oriented warm-up, i.e. simulations such as using an elastic resistance band;
- Specific warm-up, i.e. shooting arrows.

Archers should not put on any part of their equipment, especially their quiver and chest guard (if any), while preparing for warm-up.

11.1.1. Cardio-Vascular exercises

It is suggested that the warm-up start with the athletes participating in light cardiovascular exercise, such as jogging, jumping jacks or even a brisk walk.



After a few minutes of light cardio, the warm-up progresses to other exercises, for example:

Leg Crossing



Alternate passing one leg below the other one

In addition to being an excellent general warm-up exercise, leg crossing (pictured above) strengthens the core and the pushing muscles.

11.1.2. Movements of general warm-up

Warm-up exercises must to be done prior to stretching exercises in order to loosen up the muscles and ensure good blood flow.

11.1.2.1. Torso warm-up

Torso Twisting

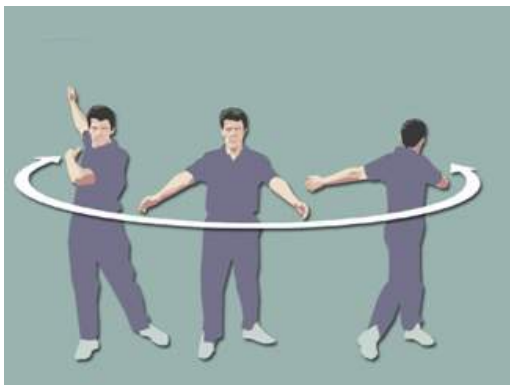
First step:

Let the archer stand on both feet with arms spread to the sides. The torso, pelvis and legs are kept still. The extended arms are balanced from left to right in the horizontal plane at different heights. Hands are kept relaxed and heavy.



Second step:

Pivot the torso and hips in a turning movement. Hands and arms stay balanced at different heights, relaxed and heavy, merely following along with the motion.



Torso rotation

Third step:

Keep the torso rotated for several seconds on one side, while turning the head from side to side three times. The head must be in an up-right position. Repeat on the other side.

Bent Over Trunk Twist

Instead of twisting the torso upright, this exercise can be done bent over.

Have the novice stand with their arms horizontally extended to the side, and their knees straight but not locked. Start the exercise by bending the trunk forward. With a horizontal torso (bent at the hips) twist so that the left hand reaches for the right foot (and touches it if possible) and then reverse for the right hand to the left foot. The arms stay straight throughout and the hands travel through a long arc from roughly straight up to reaching for the opposite foot.



This exercise is done alternately to complete a set of 6 to 10 repetitions with smooth transitions with no pause between sides.



Alternatively, one hand to the opposite foot

Hip Rotation

Instructions:

Have the novice stand with their hands placed on their hips and then rotate the hips in clockwise and counter clockwise direction. Complete 6 to 10 rotations in one direction first before doing the opposite direction.



Torso circles

Instead of rotating the hips, the novices can rotate the upper body as the Mexican women's team is demonstrating below.



In this variation, the shoulders make a circle above the hips and feet, first clockwise, then anti-clockwise. Some movement of the hips to maintain balance is natural.

11.1.2.2. Leg warm-up

Knee Rotations



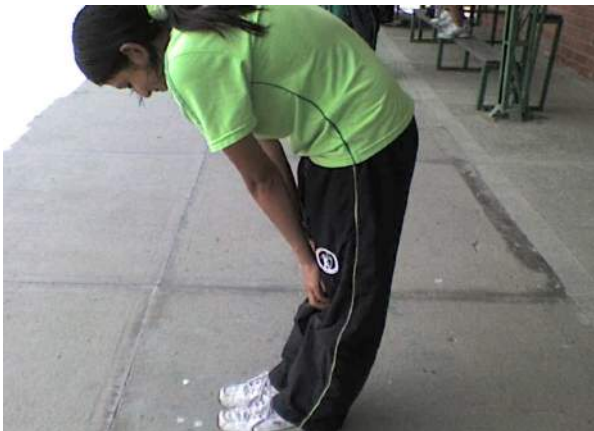
The athlete bends their knees slightly, then makes circles with them in the air above their feet, 6 to 10 repetitions going clockwise, then 6 to 10 anticlockwise.

Tiptoe Squats

The novice places their feet side by side, then rises to a tiptoe position (up on the toes). From this position they slowly squat down as low as possible while maintaining balance.



From the squat position, the novice slowly rises to a standing position again, then presses the knees lightly backward, letting their heels touch the ground.



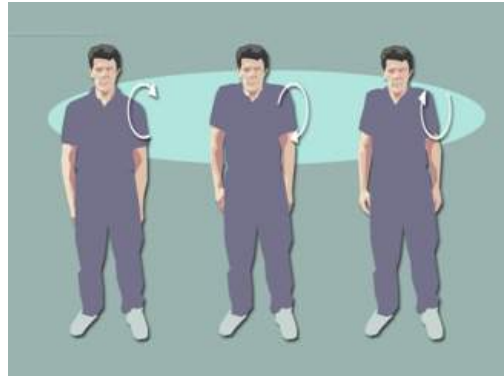
The novice should perform a set of 6 to 10 slow, controlled squats.

11.1.2.3. Shoulder warm-up

Shoulder Rotations

Instructions:

From a standing position, with their arms down at their side, have the novice move their shoulders in the biggest circle possible, clockwise for ten rotations, then counter clockwise for ten.



Shoulder rotation

The goal here is steady-paced, large shoulder circles rather than quick, small circles.

From this point on, associating breathing with the warm-up exercises will help regulate pace and focus. In this case:

- inhale while rotating the shoulders up;
- exhale on the rotation down.

Pivoting Arms

Instructions:

Have the novice position the upper arms horizontally at shoulder level with the forearms square to the arms: one up and the other one down. Rotate the forearms up and down, as shown in the illustration below.



Pivoting arms

11.1.2.4. Elbow, wrist and finger warm-up

Rotations of the Elbows & Wrists, and Fingers

Instructions:

Have the novice start this exercise by putting their palms together with their arms straight out in front of them. (Position #1)



Position #1



Position #2

In a continuous sequence, curve the fingers, bend the wrists, flex the elbow, and bring the hands inward to the chest while rotating the elbows at the same time (position #2).



Side views

Then have the novice reverse the motion to finish with their hands back in the starting position.

Elbows, wrists and fingers can also be warmed-up through separate exercises. Some examples are listed below.

Forearm Circles Around the Elbows



Instructions:

Stretch the left arm horizontally out in front of the body. Place the palm of the right hand below the left elbow. Bend the left arm and rotate the left hand toward the body. Pass the left hand inside the enlaced arm, then straighten the arm out again. Reverse the process to return to the starting position. Complete a set of 10 repetitions and then perform the exercise from the start with the other arm.

Wrist Rotations with Hands Clasped

Instructions:

Start with hands clasped, upper arms parallel to the ground and lower arms in a vertical position.

Let the novice rotate the wrist in clockwise and counter clockwise directions. Complete a set of 10 rotations in one direction before switching to the other direction.



Wrist rotations

Finger Warm-ups

"Finger Flicks:" Warm-up the fingers by rapidly opening and closing the hands.



Rapid hands opening and closing

"Piano Playing:" moving the fingers quickly in the air as if playing an invisible piano.



Piano playing

Perform either exercise continuously for 30 seconds before moving on.

11.1.2.5. Neck warm-up

Note: Be aware that rotating the head in a circular motion is not always recommended; hence we have not included it here.

Neck Extension and Flexion

Instructions:

For this exercise, have the novice start with their head upright, looking straight ahead and with their shoulders relaxed (Position #1). They then let their head tilt forward into neck extension, where they are looking at the ground (Position #2). Returning slowly to Position #1, they pause briefly before tilting their head backwards so they are looking at the sky or ceiling in neck flexion (Position #3).



Position #1



Position #2



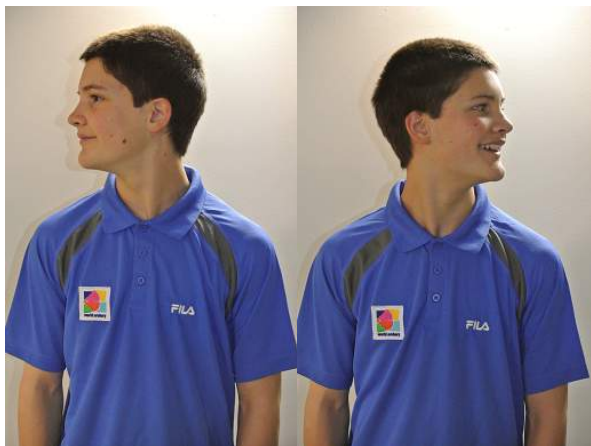
Position #3

For this exercise, the novice should breathe in while moving the chin upward and breathe out while lowering the head down towards the chest. Complete 10 cycles before moving on to the next exercise.

Turning the Head Right, Centre and Left

Instructions:

Have the novice start with their head facing forward. They then turn their head to the direction of the shoulders, alternating between left shoulder and right, with a brief pause at the starting position.



Head turn

The novice should inhale while turning to one side as far as possible and exhale while turning to the other side.

Neck Bending Sideways

Instructions:

Starting with the novice's head upright and facing forward, have the archer bend his neck sideways alternating between left and right sides. The idea of the exercise is to bring the ear towards the shoulder on each side.



Lateral neck bending

Lowering the shoulder opposite to the direction of head canting introduces a stretch to the movement, which is the subject of the next exercise.

All of the previous three neck exercises help loosen tight muscles around the neck and shoulders.

11.1.3. Stretching

In addition to aerobic and strength capabilities, it is important to consider and to continuously develop the flexibility and the articular ability of the archer.

A definition of flexibility and articular ability is: *"The absolute range of movement in one articulation or series of articulations achievable during a specific action with the assistance of a partner or a gymnastic apparatus"* (Gunnarson 2001).

This definition states that flexibility is not something generic but is specific to a defined articulation or series of articulations. In general, people are not naturally flexible to the same degree in all areas of their body. Flexibility or good articulation in a specific area of the body does not necessarily guarantee flexibility elsewhere.

Good articulation in the upper body does not always mean good articulation in the lower body

There are many quantitative variables that produce some general conclusions about a novice's likely overall articulation and flexibility.

Gender: women are generally 10%-15% more flexible than men.

Age: young people have a superior degree of plasticity due to the characteristics of the skeleton and of the tendinous-ligamentous apparatus, along with the internal temperature and the viscosity of the interstitial liquids of the body. For this reason, an adequate warm-up is very useful to obtain the maximum degree of articular mobility by the novices.

Obviously, the development of the articular ability must be mainly orientated to the muscular zones that need it to better perform specific sport actions. For instance in archers, it is the pectoral muscle that allows, or limits depending on the stretching capability, the alignment of the shoulders following the extension of the back muscles.

This does not mean that the "non-primary" zones for specific sport actions should be neglected, but, obviously, the ability to obtain high level performances involves a rather emphatic specificity.

In almost all situations it is necessary to identify the antagonist muscle to the operative motor action. In opposition to a muscle operating a traction, or producing a stretch, there is one that must (for obvious reasons of equilibrium) release and comply with the mechanical processes occurring in that specific muscular zone. This muscle is called the antagonist and it must be the target of primary focus during the training to increase articular freedom in the area.

During an archery practice, the areas where it is necessary to operate with particular care to obtain the maximum of mobility, are:

- The neck;
- The shoulders;
- The entire spine;
- The hands and the fingers.

And to a lesser degree the hips (for disciplines that encounter uneven footing).

Stretching should be done only when well warmed-up, because it is safer to stretch warm muscles than cold muscles.

The stretch itself should take place during each exhale in smooth motions, with no jerking or bouncing. The novice should stay relaxed and not force the stretches more than 70 - 80% of what they can do.

Have the novice hold the stretch on each exhale for at least 10 seconds for small muscles, 15 seconds for average muscles and 20 seconds for large muscles.

An isometric effort (muscular contraction without any movement) before stretching is another good idea.

The following is a good group of stretching exercises for novices.

11.1.3.1. Torso stretch

Back Stretch with Enlaced Elbows

Place the left elbow inside the right one. The left forearm wraps around the right one to allow the hands to enlace together.



Enlaced elbows

Push the elbows forward, and then lean the top of the body forward. The novice moves the elbows as far as he/she can in any direction and feels the stretch associated with each elbow position.

General Body Stretch in Pairs

Facing each other, the novices place one hand on each shoulder of the other. Then they step backward until their torsos are parallel to the ground.



Spreading their feet a little wider than shoulder width, the novices twist in alternating directions.



Vertical Overall Upward Stretch

Extend the arms up with enlaced fingers and hands positioned palm-up. The novice pushes up as high as they can. Hold for 15 seconds.



Side Bending in Pairs

The novices stand side-by-side facing the same direction and clasp hands or grab each other's wrists. Bracing their inner feet against each other, they lean away from one another as shown below.



Side Bending / Side Stretching

Instructions:

The novice stands with feet shoulder width apart. Bend the torso sideways with one arm stretched upward (position #1). Reverse for the opposite side (position #2).



11.1.3.2. Shoulders

Posterior Shoulder Stretch

Instructions:

- a) Push an elbow against the opposite hand for 15 seconds.



Isometric push forward of the right arm

- b) Stop the isometric effort and cross the legs with the opposite leg to the stretched side in front.



Posture for a better stretch of the back shoulder

- c) Pull on the elbow while twisting the body by turning the hips in the opposite direction to the stretch. Hold for 15 seconds per arm. The novice should feel the stretch in the upper arm and the posterior shoulder.

Back-of-Shoulder Stretch in Pairs

The novices stand side-by-side with their right feet together toe-to-heel and legs overlapping (see image below). Taking each other's left hand, they lean away from one another to stretch the left shoulder. Reverse and repeat for the right shoulder.



High Elbow Stretch

Instructions:

As shown in the picture below, have the novice place a hand on the opposite elbow behind their head.

- a) Have them push the elbow upward against the opposite hand for 15 seconds.



Isometric push upward of the right elbow

- b) Stop the push and cross the legs with the leg from the stretched side in front.



Shoulders and sides stretching

- c) Pull the elbow for 15 seconds. For a better stretch, push the hips toward the stretched side. The stretch should be felt in the shoulder and the body side. Do the same for the opposite arm and side.

Medial Deltoid Stretch

Have the novice clasp their hands behind the back. The Yoga name of this posture is "Cow Head."



Medium deltoid stretching

If the novice cannot grasp the fingers, have them pull the elbow that is pointing downward with the opposite hand, as shown in the picture on the right hand side.

Hands Clapsed Behind the Back, Fingertips Toward the Neck.

Have the novice join their hands (palm against palm) behind the back, with their fingers pointing down. Ask them to flip their hands upward as illustrated below.



Joined hands behind the back

Front-of-Shoulder Stretch in Pairs

One novice stands in front of the other, looking away with their hands together behind their back. The second novice gently raises the hands up. The novices must communicate well to avoid injury from overextending the lift.



11.1.3.3. Chest stretching

In Pairs

One novice stands in front of the other with their hands on their hips. The second novice takes the other's elbows and gently squeezes them together.



11.1.3.4. Neck stretching

Nape and Trapezius

The "Pigeon Neck" consists of an upward stretching of the neck while flattening it out at the back, bringing the chin in and lowering the shoulders. This is a good warm-up exercise for the thorax expansion of the archer.



The "Pigeon neck" an upward nape stretching

Trapezius

Similar to the previous exercise, "Pigeon Neck", except the neck is stretched obliquely.

- Push the head against the hand for 15 seconds.
- Stop the effort and lower the opposite shoulder.
- Only one or two fingers should be used for stretching, as a vigorous pull could hurt the muscular fibers and/or tendons. Maintain the stretch for 15 seconds on each side.



Trapezius stretching

Nape and Upper Back

- 1) Push the head into the hands for about 15 seconds while breathing naturally.
- 2) Stop the effort and bring the elbows together.
- 3) Let the back curl under the weight of the arms and hold the stretch for 15 seconds. Accompany this bending and stretching with a long and deep exhale.



Nape and back stretching

11.1.3.5. Some legs stretching

Hamstring and Calf Stretch (Rear part of the legs)

With one foot planted on the ground and the other a short distance in front, have the novice grab the toe of the forward foot, bending at the knee as necessary. Alternate between pulling up on the toe for a calf stretch and straightening the leg for a hamstring stretch.



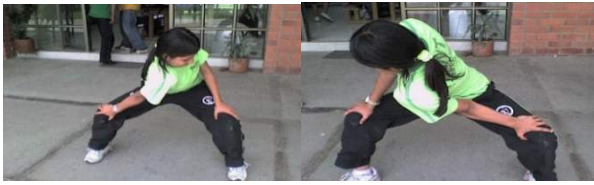
Quadriceps Stretch (Front thighs)

The novice grips one ankle with their hand and pulls or holds the lower leg off the ground. Bringing the heel towards the buttocks and pushing the hip forward and knee back will deepen the stretch.



Elbow presses in between the legs

With a straight elbow press the knee gently to the side, while at the same time turning the trunk to the opposite side.



At the conclusion of every shooting session, the above stretching exercises are also good as the cool-down activity.

11.1.4. Warm-up through effort production

Introduction to Strengthening

Because archery is based on effort production from a stable and strong foundation, it is essential for the coach to make time to suggest ways in which the novices can develop their strength. Due to the limited number of weekly entry level classes available to most archery clubs, the best time is often after the warm-up and before shooting.

This section on strengthening contains exercises that can be conveniently integrated into a shooting session. In particular, those that do not require any apparatus, or only require a stretching band - an essential item in archery education. Many entry level coaches also use an elastic resistance band to show novices strengthening exercises they can do between archery classes.

11.1.5. Directed warm-up with rubber band

As noted in the introduction, many exercises with a rubber band or tube can be undertaken during warm-up. Nevertheless in this section, only “directed” exercises are outlined; i.e. situations in which the novices have to implement physical efforts and activities that are similar to the act of shooting, but without a bow.

Most archery coaches conduct some shooting simulations with an elastic band or tube before shooting with the bow and arrows.

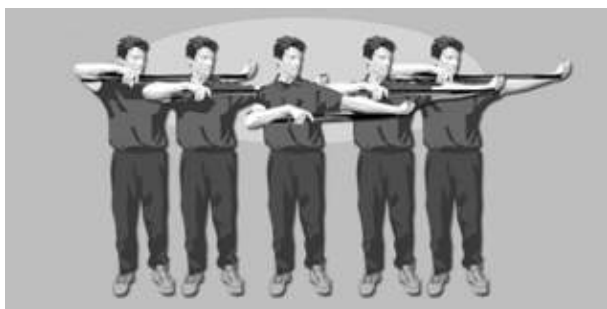
Draw simulation with the Rubber Band around the String Elbow and the Bow Hand

Have the novice start with a high pre-draw, and then, letting the elastic band slide through the fingers of the string hand as needed, cycle through the following:

- a) a draw from the above shoulder level while inhaling;
- b) a let-down below shoulder level while exhaling;
- c) a draw from below shoulder level while inhaling;
- d) a let-down above shoulder level while exhaling;
- e) Repeat starting at a) for 15 cycles.



Elastic band around the string elbow



Oriented warm-up of the string shoulder

Shooting simulation with an elastic band

Instructions:

Have the novice carry out the shooting process using an elastic band in place of a bow. Ensure that the working muscles maintain their tone after the release of the elastic band.



Shooting simulation with a rubber band



The coach should check and assist each novice with their shooting form. Have the novice perform the task with their eyes closed in order to have them focus on the feeling of the shot.



Shooting simulation eyes closed with a rubber band

11.1.6. Shooting warm-up

This is the final warm-up phase and is often implemented using a blank buttress.

During this phase review what was taught during the previous practice session. After this review, the coach will either choose to either teach a new skill or to reinforce the previous one.

If the decision is made to continue working on a previously learned skill, it is a good idea to incorporate the circuit of cut-out target faces from the Standard Teaching Process in the shooting warm-up.