

How to Measure PHV (Williams, 2009a; Williams, 2009b)

Tools and equipment for measuring:

When considering the equipment needed for measurement, one must look at how much emphasis is going to be put on the measurement of stature. If stature data is going to be heavily incorporated into training plans, data must be very accurate, and thus, the more expensive the purchased equipment should be.

Ideal equipment:

- A free standing or wall mounted stadiometer
- This stadiometer would need to have sliding headboards and a dial or digital (or digital read outs, which would aid in the ease of use

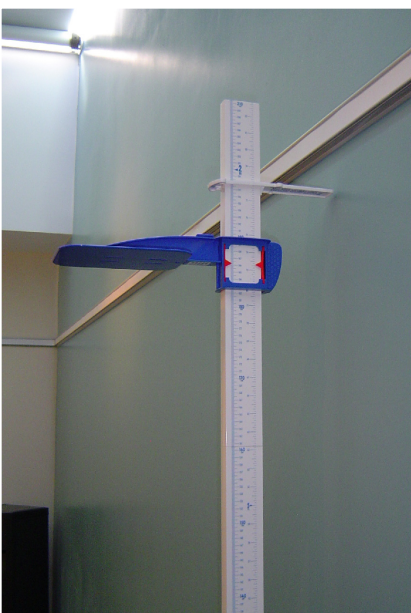
Acceptable equipment includes:

- An anthropometer or retractable steel measuring tape
- A headboard
- A smooth floor with a straight flat wall at 90 degrees

Unacceptable equipment includes:

- A cloth measuring tape
- Flexible material
- Carpeted floor
- An uneven floor
- No backboard

Figure 6. Example of a Free Standing Stadiometer



Why is Measurement Accuracy so Important?

As previously mentioned, proper technique when measuring an athlete is extremely important, as random and measurement errors are common. It is the responsibility of the person measuring to ensure such errors are minimized, as the more errors there are, the harder the results will be to interpret. Similarly, the more errors there are the less value the results will have. To decrease error, ensure:

- The environment is consistent and controlled
- Clothing is consistent and not bulky
- Feet are bare
- You have the cooperation of the athletes
- You follow standardized and consistent procedures

What to Measure?

Determining the rate of growth is dependent on accurate measurements; therefore, measurements need to be made to the nearest 0.1 cm. Each athlete should be measured and recorded twice, but these measurements should not differ by more than 0.4 cm. If they do not differ by more than 0.4 cm, the mean of the two measurements should be taken. If they do differ by more than 0.4 cm, a third measurement should be taken, and the median of all three measurements should be calculated (Williams, 2009a).

How Should Growth be Measured?

When measuring a child's height, it is important to pay special attention to technique, if the results are to be of use. Ideally, two measurers should be present; one to perform the positioning of the athlete, while the other records the measurement. If a second measurer is not available, it is still possible to get valid results; however, extra attention to technique should be paid.

For proper measurement of height refer to Figure 7.

The orbitale (O) is located on the lower or most inferior margin of the eye socket. The trignon (T) is the notch above or superior to the tragus or flap of the ear, at the superior aspect of the zygomatic bone. This position corresponds almost exactly to the visual axis when the subject is looking directly ahead.

Example 1

Two measurements within 0.4 cm of each other

Stature measurement #1	166.2 cm
Stature measurement #2	166.3 cm

The above two measurements are within the acceptable range and the mean measurement recorded as 166.3 cm.

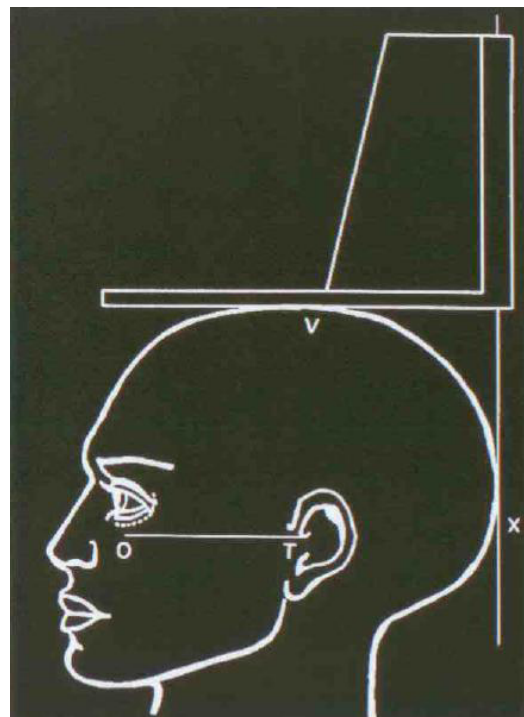
Example 2

Two measurements **not** within 0.4 cm of each other

Stature measurement #1	158.2 cm
Stature measurement #2	162.9 cm
Stature measurement #3	162.6 cm

The above two measurements are not within 0.4 cm of each other; therefore, the median of the three scores needs to be used and the recorded score is 162.6 cm.

Figure 7. Orientation of the Head in the Frankfort Plane (Ross, Carr & Carter, 2000)



Protocol for Sitting Height Measurement (Simmons, 2000)

- Student sits on the base of the stadiometer with knees slightly bent. Hands rested on knees.
- The buttocks and shoulders rest lightly against the stadiometer, which is positioned vertically behind the student. Ensure there is no gap between buttocks of student and stadiometer.
- The tester applies gentle upwards traction to the skull behind the ears to ensure the trunk is fully stretched.
- Draw down the measuring bar to the student's head and record sitting height to the nearest 0.1 cm.
- Once sitting height is calculated, it can be subtracted from the stature score, in order to derive the leg length height.

Figure 8. Measuring Sitting Height



Protocol for Standing Height Measurement (Simmons, 2000)

- The student stands erect in bare feet with heels, buttocks and shoulders pressed against the stadiometer.
- The heels are together with arms hanging freely by the side (palms facing thighs).
- The tester applies gentle upward traction to the skull behind the ears.
- The student looks straight ahead, takes a deep breath and stands as tall as possible.
- Draw down the measuring bar to the student's head and record standing height to the nearest 0.1 cm.

Figure 9. Measuring Standing Height



Protocol for Arm Length Measurement (Simmons, 2000)

- Mount a tape measure on the wall about shoulder height of the students being tested. Ensure the starting point of the tape measure is fixed to a corner of a wall. This is where the student's fingers must be fixed.
- The student stands erect with their stomach and toes facing the wall, feet together and head turned to the right.
- The arms are extended laterally at shoulder level (horizontal) with palms facing forwards. Fingers stretched.
- The tip of the middle finger is aligned with the beginning of the tape measure (corner of wall) and arms are out-stretched along the tape measure.
- Use a ruler held vertically to the tape measure to record total arm span to the nearest 0.1 cm.

Figure 10. Measuring Arm Span



Ethical and Sensitivity Issues (Williams, 2009a; Williams, 2009b)

When conducting the measurement of growth, it is important to realize the ethical and sensitivity issues surrounding the measurement and monitoring of a child's development.

Coaches must understand not only the physical changes to a child's shape and size, but also the implications they can have on personality and the child's perception of their own body, as well as other people's perception of their body. Coaches are in a unique place, in that they can offer good advice and educate their athletes in a sensitive and appropriate manner.

(See CS4L Physical, Mental, Cognitive and Emotional Development at www.canadiansportforlife.ca)

Figure 11. Life-cycle of Physical Activity and Sport

