

THIGH AND ABDOMINAL CIRCUMFERENCE

1. Background and Rationale

1.1 Thigh circumference. Thigh circumference is an important indicator of muscle atrophy due to disease or injury. In addition, it may be a useful indicator of adiposity or lean body mass. Mid-thigh circumference will be measured using the right thigh at the midpoint between the inguinal crease and the proximal border of the patella.

1.2 Abdominal circumference. The abdominal circumference is an anthropometric indicator of subcutaneous and deep adipose tissue. In past studies, measurements have been taken at the level of the umbilicus and natural waistline. In Health ABC, the measurement will be made at the maximum circumference because it may be a better indicator of adipose tissue. This level is the area between the lower rib and the iliac crest, usually, but not always, at the level of the umbilicus,

2. Equipment and Supplies

- A flexible inelastic fiberglass tape (about 0.7 cm wide) that is marked in centimeters alone on one side. (Confusion may arise if the tape is marked in centimeters and inches on the same side).
- Grease pencil
- Chair
- Mirror hanging at waist level in clinic room

3. Safety Issues and Exclusions

The measurements of thigh and abdominal circumference should not pose any safety problems to the study participants provided that they can stand independently.

4. Participant and Exam Room Preparation

Study participants should be encouraged to empty their bladder and/or bowels prior to these measurements.

Script: "The measurement that we are about to take is more accurate if you use the bathroom before we measure you. If you need to use the bathroom it is down the hall."

The measurements will be taken over bare skin. Participants should be dressed in a clinic gown so that appropriate landmarks can be located and should be instructed prior to the visit not to wear restricting or compressing undergarments, such as girdles or panty hose, which could interfere with the measurement. The thigh measurement is taken on the same side as the quadriceps strength measurement, generally the right side.

5. Detailed Measurement Procedures

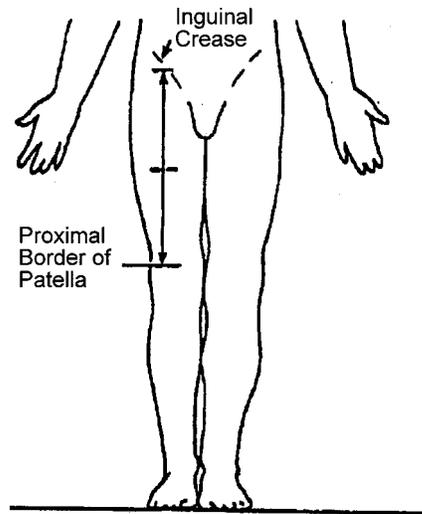
5.1 Thigh Circumference

Measure the thigh on the same side used for the isokinetic dynamometer (Kin-Com) strength measurement. This will be the right side unless contraindicated for the Kin-Com test.

- 1) The participant should start out sitting on a chair, with the knees flexed to about 90 degrees and the thighs horizontal.

Script: "I am going to measure your right thigh circumference. In order to do that I first have to mark your thigh with a cosmetic pencil to determine where to do the measurement."

- 2) Mark the proximal border of the patella (knee cap). To help locate the landmark, ask the participant to straighten their leg to about a 120 degree angle while keeping their heel on the floor with the thigh muscles relaxed.
- 3) Locate the midpoint of the inguinal crease (see figure below). This is easily located if the hips are flexed as they will be with the patient seated. To help locate the landmark, ask the participant to lift the thigh about 1 cm. The point where the muscle and tendon contract is the midpoint of the crease.



4) With the patient seated and the thigh muscles relaxed, measure, and record on the form, the distance between the inguinal crease and the proximal border of the patella and divide by two to get the midpoint (record the midpoint on the form also). Mark the location with a grease pencil.

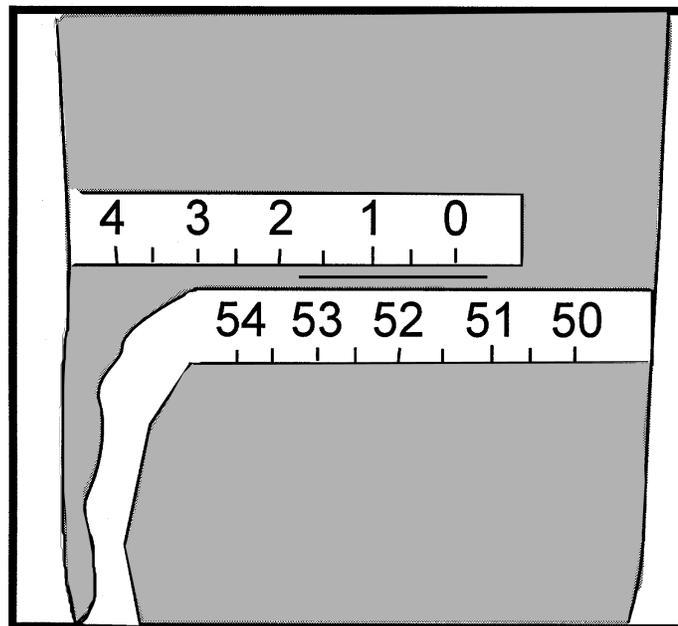
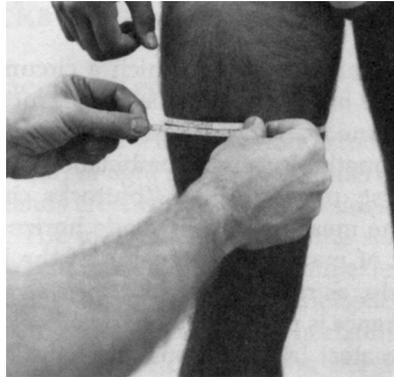


5) Ask the participant to stand up and place the heels about 20 cm apart.

The weight should be evenly distributed over both feet, both feet flat on the floor. If balance is a problem, the participant may hold onto a chair or wall. The examiner should be squatting so that their eyes are at the level of the mid thigh.

6) The circumference is measured at the marked midpoint with the measuring tape placed horizontally (that is, perpendicular to the long axis of the thigh) around the thigh. View the thigh from the front and both sides to check this. The tape should be in complete contact with the skin, without compressing the soft tissue. The midpoint mark should be visible in the gap made by the upper and lower wrap of the tape. Make sure that the lower edge of the tape at the zero mark sits directly at the top of the midpoint mark. Make sure that the top edge of the lower wrap of the tape sits directly

below the midpoint mark. Read the value directly below the zero mark (see example in figure on next page: measurement is 51.4 cm).



- 7) Record the circumference to the nearest 0.1 cm and mark which thigh was measured.
- 8) Remove and reposition the tape. Repeat the measurement. If the difference between the measurements is > 1 cm, a third and fourth measurement should be obtained. Record all the measurements. The computed value will be the mean of the two or four recorded values.

5.2 Abdominal circumference

1) Ask the participant to stand with their weight equally distributed on both feet, arms hanging at their side, and head facing straight ahead. They should relax their abdomen and breath normally. The examiner should be sitting or squatting at the side of the participant so that their eyes are at the level of the waist. It may be necessary to view the participant alternately from the front and the side to locate the largest circumference.

Measure the abdominal circumference directly over bare skin. If necessary, lower pants so that waist bands do not produce a bulge in tissue.

2) Pull the tape around the participant's middle at the level of largest circumference with the tape in a horizontal plane. This tends to coincide with the greatest protuberance of the abdomen, as seen from the side. The greatest protuberance is usually at, or near, the level of the umbilicus.

If the largest circumference is obstructed by e.g., stomach pouch, obtain measurement, and mark on the form. In very obese participants the maximal truncal circumference may be at hip level. In this case, measure the widest circumference in the region between the lower ribs and the iliac crest and indicate on the form that the actual maximal circumference was at hip level.

Use a wall mirror hanging at waist level to be sure the tape is in the same horizontal plane all around. An assistant may sometimes be needed to help position the tape behind the participant. Alternately, have the participant help hold the tape in position. Bending their arm slightly should not affect the measurement as long as they maintain an erect posture.

Hold the tape snug against the skin, without compressing the tissue, and with its zero end below the value to be recorded.

3) Make the measurement at the end of a normal expiration to the nearest 0.1 cm.

Script: "I'd like to take a measurement around your middle where it is the largest. I may need to move some of your clothing out of the way. Breath normally. Don't hold your stomach in. Just relax."

4) Remove and reposition the tape. Repeat the measurement. If the difference between the measurements is > 1 cm, a third and fourth measurement should be obtained. Record all the measurements. The computed value will be the mean of the two or four recorded values.

6. Procedures for Performing the Measurement at Home

Same as described above.

7. Alert Values/Follow-up/Reporting to Participants

If they request, the participants will be told of the measurements at the time of the exam.

8. Quality Assurance

8.1 Training Requirements

No special qualifications or experience are required to perform this assessment. Training should include:

- Read and study manual
- Attend HABC training session on techniques (or observe administration by experienced examiner)
- Practice on volunteers with a special emphasis on obese participants (Goal: differences between repeat measurements ≤ 1 cm)
- Compare measurements with those made by experienced colleagues (Goal: keep differences in any measurement ≤ 1 cm)
- Discuss problems and questions with local expert or QC officer

8.2 Certification Requirements

- Complete training requirements
- Conduct exam on 2 volunteers:
 - According to protocol, as demonstrated by completed QC checklist
 - Differences between repeat measurements ≤ 1 cm
 - Differences between trainee's and QC Officer's measurements should be ≤ 1 cm.

8.3 Quality Assurance Checklist

Tape is inelastic, marked in cm only on one side

Thigh circumference

- Measurement made on same side as quadriceps strength
- Side measured indicated on form

- Records distance between inguinal crease and proximal border of patella
- Locates the landmarks correctly
 - midpoint of inguinal crease
 - proximal border of patella
 - thigh midpoint
- Records thigh length and correctly calculates midpoint
- Checks for tape in same horizontal plane all around (perpendicular to long axis of thigh)

Waist circumference

- Asks participant to use the bathroom, if necessary
- Places tape at the largest circumference of the abdomen, viewed from the side
- Examiner eye level at participant's waist
- Checks for tape in same horizontal plane all around
- Measurement taken after normal expiration
- Clothing is not producing a bulge in tissue
- Tape snug against bare skin, but does not compress skin
- If the first two measurements differ by > 1 cm, performs third and fourth measurements
- Reviews form for completeness
- Correctly completes form

9. Form