



KENTUCKY HIGH SCHOOL ATHLETIC ASSOCIATION WRESTLING MINIMUM WEIGHT CERTIFICATION PROGRAM

PROPER PROCEDURE FOR SKIN-FOLD MEASUREMENTS AND ANALYSIS

PURPOSE: Accurate determination of minimum wrestling weight from urinalysis (specific gravity to determine state of hydration) and skin-fold measurements (determination of percent body fat) is important to provide each wrestler with information regarding a healthful body weight for wrestling. Standardization of urinalysis and skin-fold site locations and equations is essential to calculate accurate minimum wrestling weight.

BACKGROUND: Skin-fold measurements determine the level of subcutaneous fat. That measure of fat is then used, via a prediction equation, to estimate an individual's percent body fat. Percent body fat and the individual's body weight can then be used to determine a wrestler's minimum weight at 7% body fat (12% for female wrestlers). Seven percent (twelve percent for females) body fat has been selected as the minimum level of essential body fat for adolescents and also as the minimal level for normal growth in secondary school athletes. Dehydration is a common procedure used by wrestlers to obtain weight loss. Because dehydration will affect the accuracy of determination of minimal weight for wrestlers, urinalysis will be completed prior to skin-fold measurements. With dehydration the specific gravity of the urine will increase. Athletes with urine specific gravity above a specific level indicates dehydration and the wrestler will need to be tested at another time when hydrated.

The Wrestling Minimum Weight Certification Program has been developed not to eliminate weight loss in wrestling, but to encourage healthy weight loss via nutrition education and to control weight loss to healthy levels. Many procedures (i.e., girth dimensions, underwater weighing, infrared, and electrical resistance) have been utilized to determine an individual's percent body fat. Skin-fold methods have been selected because of their accuracy, cost to the student and ease of completion. Many different equations have been developed for determining the percent of body fat from skin-fold measurements. Research has indicated that the equation used must be specific for the population measured and that the measurer should be trained. The equation used for determining minimal wrestling weight was developed by Lohman (1981) and modified by Thorland et. al (1991). Research with over 850 high school wrestlers from five Midwestern laboratories along with cross validation on Wisconsin high school wrestlers by Clark et. al. (1990) has indicated accuracy for both the technique and formula for secondary school wrestlers.

GENERAL PROTOCOL AND PROCEDURES: All wrestlers must be assessed according to the guidelines and all parts of the assessment process (urinalysis and skin-fold) must be administered contiguously. There is no break in time between the two. No pretest sessions are permitted.

Coaches should emphasize the need for wrestlers to be hydrated. Wrestlers should also be reminded that chocolate, soft drinks and use of dietary supplements might adversely affect the specific gravity of their urine. It is recommended early morning assessment be avoided because of the hydration factor being effected by the night's respite.

Make sure you have duplicated enough copies of the Wrestling Weight Permission Form to ensure a copy for the school's athletic director and your own files. Computer generated forms may be used if they include all items on the official form. ***Assessors must use the prescribed form for all testing, either electronic or paper forms.***

STANDARDIZATION: A key aspect of effective determination of minimum wrestling weight is standardization of testing. Standardization includes:

1. Determination of the state of dehydration by using a reagent strip or a urinometer. Specific gravity shall be 1.020 or lower. The reagent strip is the recommended verification method.
2. Standardization of skin-fold site location and measurement techniques. All measurements must be determined with the same techniques and at the same locations.
3. A standardized equation for predicting body density and percent body fat. The Lohman equation with three different skin-fold sites is used to determine body density and the Brozek equation is used to convert body density to percent body fat.
4. Minimal wrestling weight is based upon seven percent (7%) body fat for males, and twelve percent (12%) for females.
5. Consistent certification of all urinalysis and skin-fold assessors.

ASSESSMENT PROTOCOL

Testing must proceed in the following order:

1. Urine sample collected and specific gravity determined. The testing is over if the wrestler does not meet the required standard for urine gravity. The test will be required to be conducted on another day, starting with the urine gravity analysis. At start of testing, hydration level is tested using reagent strips. Reading of greater than 1.020 will result in automatic cancellation of test, and cannot be re-tested for 48 hours. This test result would indicate dehydration at a level that cannot be permitted.
2. Body weight determined.
3. Fat analysis through use of skin-fold measurements or other electronic device.

EQUIPMENT: Instruments required for determination of minimal weight include:

1. Reagent strips and/or urinometer and glass cylinder. There are links on the KHSAA web site detailing vendors for these strips.
2. Lange or Harpenden calipers for determining skin-fold thickness, or electronic impedance devices may be used under the given conditions.
3. A cloth tape measure to measure skin-fold sites from anatomical landmarks if the Lange or Harpenden calipers are used.
4. A felt tip pen for marking skin-fold sites.
5. A Toledo or digital body weight scale for determining body weight at the time of skin-fold measurements.
6. Copies of the Wrestling Weight Permission Form.

URINALYSIS

Dehydration is a common procedure used by wrestlers to lower body weight to compete in a lower weight class. Dehydration will concentrate the urine and increase the urine's specific gravity. Accurate determination of minimum wrestling weight from skin-folds requires the wrestler to be hydrated. The specific gravity of water is 1.000 and the specific gravity of a hydrated individual will be 1.020 or lower. Urinalysis by specific gravity of the urine will be completed BEFORE skin-fold measurements. If the wrestler is dehydrated (i.e., specific gravity of the urine is over 1.020), skin-fold measurements will NOT be completed and testing must be rescheduled for a different time when the wrestler will be hydrated. Record the results of the specific gravity measurement at the beginning of the skin-fold measurement data form.

OBTAINING A URINE SAMPLE - Reports of wrestlers using various techniques to bypass the urine testing have been reported. Therefore the following procedures are required to assure appropriate urine sample has been collected.

- **AREA:** A bathroom with toilet or urinal can be used by the wrestler to provide the urine sample. The determination of specific gravity can be completed in another area, but a means of appropriate disposal of the urine must be available.
- **SAFETY:** Use gloves when measuring the urine and appropriately dispose of the urine in the toilet and rinse the urinometer, if used. Place the cup in a hazard collection system.
- **COLLECTION CONTAINER:** Paper cups of sufficient size to provide a 20-30 ml urine sample can be provided to the wrestler to collect the sample.
- **COLLECTING THE URINE SAMPLE:** School personnel must ensure that the wrestler has provided a sample of his/her urine for measurement. Normally one to three wrestlers can be supervised at one time in an open area. After collection of the urine by the wrestler, personnel should insure that the urine is warm by feel in the collection container. If the urine is cold, reject that sample and require the wrestler to provide another sample under closer supervision.

DETERMINING SPECIFIC GRAVITY - Specific gravity can be determined by (1) Reagent Strips or (2) urinometer. The Reagent Strips (such as Bayer Multistix 8 SG or another Reagent Strip) cost very little. An adult urinometer costs under fifteen dollars. The reagent strips will provide prompt use during testing while the urinometer will require filling, testing, disposal of the urine and rinsing with each use. Both techniques are acceptable. The assessor will have to determine which process they will employ.

REAGENT STRIP

1. Mix urine well in cup by swirling urine.
2. Remove one strip from bottle and replace cap. Completely immerse Reagent areas of the strip in FRESH urine and remove immediately to avoid dissolving reagent.
3. While removing the strip from the urine, run the edge of the strip against the rim of the urine container to remove excess urine. For 45 seconds hold the strip in a horizontal position to prevent mixing of the chemicals.
4. Visually compare reagent area to the specific gravity color chart on the bottle's label by holding strip close to color blocks. Avoid laying strips directly on color chart as this will result in urine soiling the chart.
5. Discard urine in urinal or toilet and cup in an acceptable place.
6. Record pass or fail for specific gravity on Individual Profile Form. REMEMBER, if the specific gravity is above 1.020, testing cannot continue and testing must be rescheduled.
7. **NOTE:** Urine testing should be completed within one hour after voiding. If testing cannot be completed within one hour,

refrigerate the urine immediately and then let the urine return to room temperature before testing.

8. All unused strips must remain in the original bottle. Do not remove strips from the bottle until immediately before the strip is to be used for testing. Immediately replace the bottle's cap and tighten after removing the reagent strip.

URINOMETER

1. A urinometer contains a glass cylinder and a hydrometer (such as Squibb's #75280).
2. Fill glass cylinder three-quarters full of urine and place on a level flat counter. Place the hydrometer float in the cylinder and give it a gentle spin to prevent it from resting against the side of the cylinder and distorting the reading.
3. Read the specific gravity numbers on the hydrometer where the bottom of the urine crosses. Stoop if necessary to read at eye level.
4. Discard the urine and rinse the hydrometer and glass cylinder with tap water for use with the next wrestler. Discard urine in urinal or toilet and cup in an acceptable place.
5. Record pass or fail under urinalysis on Individual Profile Form. REMEMBER, if the specific gravity is above 1.020, testing cannot continue and testing must be rescheduled.

HEIGHT AND WEIGHT

A certified Toledo or digital scale (certified within the last calendar year) and an accurate means of measuring each wrestler's height to the nearest one-half (1/2) inch must be available. The assessor must check the scales for accuracy.

1. WRESTLER'S DRESS: Males must be in shorts or swimsuit only; females must be in shorts and halter.
2. RECORD HEIGHT AND WEIGHT: School personnel or a registered assessor must obtain the height and weight of each wrestler. On the Wrestling Permission Form record height and weight.

SKIN-FOLD AND SKIN-FOLD MEASUREMENTS

WRESTLER'S DRESS:

1. Males must be in shorts or swimsuit only; females must be in shorts and halter.

RAISING SKIN-FOLDS:

1. Hold the skin-fold caliper in the right hand while raising the skin-fold with the thumb and index finger of the left hand.
2. The skin-fold should be grasped one centimeter from where the actual measurement will occur. Practice will be necessary to feel the underlying adipose tissue separate from the muscle. Hold the skin-fold firmly but do not pinch to the point of pain.
3. Measure midway between the surface and the crest of the fold. Allow the caliper paddies to gently come in contact with the skin-fold. Release the mechanism so that thumb, index finger, and caliper spring tension is supporting the skin-fold.
4. Leave the caliper paddles in contact with the skin from two to four seconds. Longer contact may decrease the skin-fold value due to fluid being forced from the tissue.
5. Position yourself so you are looking directly at the caliper dial, read and record the measure to the nearest .5-millimeter.
6. Take two measurements at each site in serial fashion. If the difference is less than or equal to .5 millimeter record the average. If the difference is greater than .5 millimeter, take a third measurement and record the average.
7. Record skin-fold measurements on Wrestling Permission Form or in the electronic spreadsheet.

SKIN-FOLD LOCATIONS

TRICEPS

1. The triceps skin-fold is measured on the midline of the posterior aspect of the upper arm, over the triceps muscle.
2. The fold is measured midway between the posterior-lateral aspect of the acromion process of the scapula and the olecranon process of the ulna.
3. The elbow should be flexed to 90 to locate these landmarks. Use a tape measure and mark the location.
4. The elbow should then be extended and fully relaxed at the side to raise the skin-fold.

SUBSCAPULAR

1. The sub scapular skin-fold is raised on a diagonal one centimeter below the inferior of the scapula.
2. With the arms comfortably at the side of the trunk, palpate the vertebral border with the fingers until the inferior angle is identified. The inferior angle is the lowest part of the scapula.
3. To aid identification of the site in a well-muscular wrestler, place the arm behind the wrestler's back. The vertebral border and inferior angle of the scapula should become more evident. In most instances the location identified by a natural hollowing of the skin when the arm is placed behind the back.
4. Return the arms to the sides and be sure the shoulders are level and relaxed while raising the skin.

ABDOMINAL

1. The skin-fold is raised vertically on the right side of the wrestler's abdomen three centimeters from the midpoint of the umbilicus.
2. The athlete should stand with the weight equally distributed on each foot.
3. Encourage the wrestler to breathe normally and relax the abdominal wall.

COMMON ERRORS AND CAUTIONS IN MEASURING SKIN-FOLDS

1. Be careful to measure and mark each site. Raise the skin-fold one-centimeter above the site so the caliper paddles will be directly over the marked location. The paddles should be placed one centimeter from thumb and index finger grasping the skin-fold.
2. Be cautious to make the measurements when the skin is dry. When the skin is wet the assessor may grab excessive skin-fold resulting in larger values.
3. The measurements should not be taken immediately after a workout or when the wrestler is overheated. Fluid shifts to the skin occur as the body attempts to cool itself. This may increase the skin-fold measurement.
4. Take special care to look directly at the caliper to avoid errors in viewing from an angle.

RELIABILITY

The ease at which you raise a skin-fold from the underlying muscle will vary by the site and the person being measured. You will discover that some athletes pose a special problem. Generally, the thicker the skin-fold the more difficult it is to reproduce the measurement. Reliability is critical to success, both within a given assessor and between assessors. This reliability can be improved through:

1. Careful site identification
2. Quality training
3. Practice

Once standardization is established for the measurement protocol, the assessor must work to become proficient and comfortable with the procedures. Proficiency in measuring skin-folds will take many practice sessions on a variety of body types.

PROCEDURES OF RECORDING DATA

- 1) Data Collection and Reporting
 - a) Each school shall use the NWCA online recording system, including the sub-7%/12% permission requirements.
 - b) Each school shall throughout the year, enter weight measurements from certified scales in order to be eligible to wrestle.
- 2) Responsibilities of Schools in the Measurement Process
 - a) It is the school's responsibility to contact an approved KHSAA skin-fold measurer. The list of approved measurers can be obtained from the KHSAA website at www.khsaa.org under wrestling.
 - b) The school shall determine if the assessor is to be compensated. That compensation cannot exceed \$5 per student. It is the strong recommendation of the Association that each school designate an assessor so that the cost to the student athlete is eliminated.