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The Use of the Malar Skinfold Site as a Reference Point for Exercise and Weight Loss Programs

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Abstract

Introduction: We tested the hypothesis that the use of a malar (cheek) skinfold body composition correlates to overall body fat loss in men (N = 223, mean age 37.9 + 5 years) who participated in high intensity strength training programs.

Method: Body composition measures were conducted with skinfold calipers on nine areas of the body, including malar location. High intensity programs are defined as working out three times per week for a minimum of three months using multiple strength modalities and sessions. In addition, participants made dietary changes to include a higher percentage of protein and fat in their diet.

Result: Demonstrated that participants had a significant (36%) reduction in overall body fat (22.1% to 15.2%, $p<0.0005$). We conclude that malar measurements were comparable to other body fat measures, and statistically significant changes, vs. small and insignificant changes in total body weight and waist circumference were also seen via trend analysis.

Conclusion: We conclude that the use of a malar skinfold measurement is useful as part of a total skinfold assessment, as its measurement value is high enough to warrant its use, as well as confirming a visual reduction in fat mass in the facial area.

Keywords: Malar measurement; Skinfolds; Body composition; Weight loss; High intensity strength training; Fat free mass

Introduction

Skinfold measurements

Since the introduction of body composition measurements in sports science, researchers have been keenly interested in the distribution and changes in the amount of fat on the human body [1-4]. Skinfold measures were routinely used for measurements because they measured subcutaneous fat in a direct measure, as opposed to using other densitometric measures that would estimate the amount of fat both on and within the body [5-7].

Multiple skinfold sites

Historically, multiple skinfold sites were used that concentrated on areas of the body where the highest amount of body fat could have been observed (chest, back, abdominal, gluteal, thigh) and could be repeated over time [8,9,4]. As body fat measures became more widely used, sites were expanded to use mid-axillary, anterior chest, sternum, forearm, neck, and posterior calf [10,6,11].

Within the health club and clinical setting, the use of skinfolds was used as an initial assessment tool in the 1980s to 90s as an inexpensive and repeatable measure of performing body composition assessments. Skinfolds were used for both direct measures (total amount of skinfold in millimeters) and the use of a regression formula to estimate body composition as a percentage of total body weight. It became a standard method of assessment for decades until health clubs moved to more technical methods, such as bio-impedance, DEXA scans, hydrostatic, and whole-body plethysmography (Bod Pod machine, Chicago, IL). However, the skinfold method, if used by skilled practitioners, still gives the best direct method for repeatable measurement of subcutaneous fat in any area of the body.

The combination of traditional skinfold sites, and non-standard sites, the cheek bone, or malar measurement used on all clients at Ultimate Performance centers, is of interest in this report, since the combination which does not have precedent within sports medicine, is found in both psychology profession (masculinity and attractiveness [12,13] and oral facial surgery literature [14].

The level of training at Ultimate Performance far exceeds basic health and clinical guidelines. Their application of high intensity strength they believe is key to such dramatic fat loss [5]. The goal of this report is to highlight the non-standard skinfold (cheek) to overall fat loss as a result of participation in their unique exercise protocols.

Methods and Materials

Traditional Skinfold Measurements

The Ultimate Performance corporation, with offices worldwide in eight countries, uses informed consent and release of liability for all clients who enter their exercise programs. Each center utilizes multi-site body composition with skinfolds to assess body composition. Their use of 13 different skinfold sites varies from the following areas (Table 1).

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Table 1: Traditional skinfold measurements.

Traditional Skinfold	Measurements		
Pectoral	Sub Scapular	Mid Axillary	Abdominal
Supra Iliac/Oblique	Thigh	Hamstring	Calif

Table 2: Non-standard skinfold measurements.

Non-Standard Skinfold Measurements	
Cheek (Malar)	Neck
Bicep	Knee (Patellar)

Table 3: Traditional body circumference measurements.

Traditional Body Girth	Measurements	
Shoulder – bi lateral	Upper Arm	Waist – circumference
Hip – circumference	Upper Thigh	Calf

Table 4: Mean reduction in body fat for nine locations (measures in mm) The average reduction in body fat for eight common sites was 36.3% (P<0.0005), Reductions in malar (cheek) measurement was 21% (P<0.005).

Area Measured	Premeasure (mm)	Post measure (mm)	Percent change	Significance
Bicep	7.34 ± 4.8 mm	4.64 ± 3.6mm	37% decrease	P<0.005
Mid Axillary	18.5 ± 7.8 mm	11.2 ± 7.1mm	40% decrease	P<0.0005
Pectoral	18.5 ± 7.3 mm	11.5 ± 6.9mm	40% decrease	P<0.0005
Supra Iliac	30.8 + 13.1 mm	18.9 ± 7.4mm	38% decrease	P<0.0001
Sub Scapular	21.6 ± 12.2mm	15.3 ± 10.4mm	30% decrease	P<0.0005
Thigh	19.3 ± 7.9mm	12.4 ± 6.6mm	36% decrease	P<0.0005
Tricep	12.6 ± 5.8 mm	8.5 ± 4.4mm	33% decrease	P<0.0005
Abdominal	32.4 ± 13.7mm	20.7 ± 8.5mm	37% decrease	P<0.0005
Total Body Fat	22.61%	15.21%	36.5% decrease	P<0.0005
Malar (cheek)	11.1 ± 7.5mm	8.8 ± 4.1mm	21% decrease	P<0.0048

Non-standard Skinfold Measurements

Skinfold measures were taken three times at each location with Harpenden calipers that are accurate to 0.2 mm (Baty International Group, West Sussex, UK). Measurements were recorded on a data spreadsheet in a non-identifiable database assigning a code number to each client (Table 2).

Harpenden calipers were also used to measure non-standard areas of the body that traditionally are not used for body composition algorithms [9,10,4]. Malar measurements were taken in the method reported by Coleman [12] (Table 3).

Girth measurements

A standard digital sports medicine tape measure (Synteck devise, Miami, FL) that measures to 0.1 cm was used for all girth measures. The mean of two measurements were taken at shoulder (at mid-deltoid point bi-laterally), Upper Arm (mid bicep), Waist (in front of umbilicus), Hip (mid-point of bi-lateral Gluteus Medius muscles), Upper Thigh (halfway point from crest of femoral greater trochanter and lateral epicondyle of Femur) and calf (mid-point of Gastrocnemius muscle) [15,8,16,10]. The majority of skinfold data was analyzed on men from 30-49 years of age (N=223, mean age 37.9 + 5 years). Recorded data on all clients was analyzed using clinical chart review procedures, negating the use of IRB approval.

High intensity strength interval training

Subjects performed high intensity strength interval training (HIIT) defined as three or more sets of 10 repetitions starting at approximately 50% of their maximal strength effort, and increasing weight (load), and manipulating rest interval, and speed of contraction so a near-maximal effort (over 80%) is achieved. High intensity strength interval training is used mostly in athletic and performance regimes to have athletes peak for specific competitions. In this setting, the intensity factor allows for more metabolic utilization of anaerobic systems (ATP, ATP-LA) and forces the body to use more calories in training and recovery modes [17].

Results

Participants who train at Ultimate Performance have a high total body fat reduction based on their company platform (pre to post measurements and visual inspection), including pre and post photographs. While this has merit from a visual and marketing standpoint, the applications of skinfolds delivers a statistical version. Significant reductions in body fat are observed in Ultimate Performance clients based on age stratification. The mean areas of body fat reduction are depicted in (Table 4).

Trends in body composition varied from those of general weight and circumference measurements. As noted in Figure 1, both body weight (measured in Kg), and waist circumference measures (in centimeters) slightly trend downward, whereas all body composition measurements trend down significantly – including the malar (cheek) measurement. This observation is important because even though the malar measurement is not used as frequently in body fat testing (similar to bicep and triceps), it was reduced substantially and significantly (Figure 1).

Discussion

As more sports medicine facilities, health clubs, and clinics increase their use of high technology tools to measure body fat percentage [18], the use of skinfolds still has its place regarding the direct measure of specific sites over time. It also presents a skill that has been the hallmark

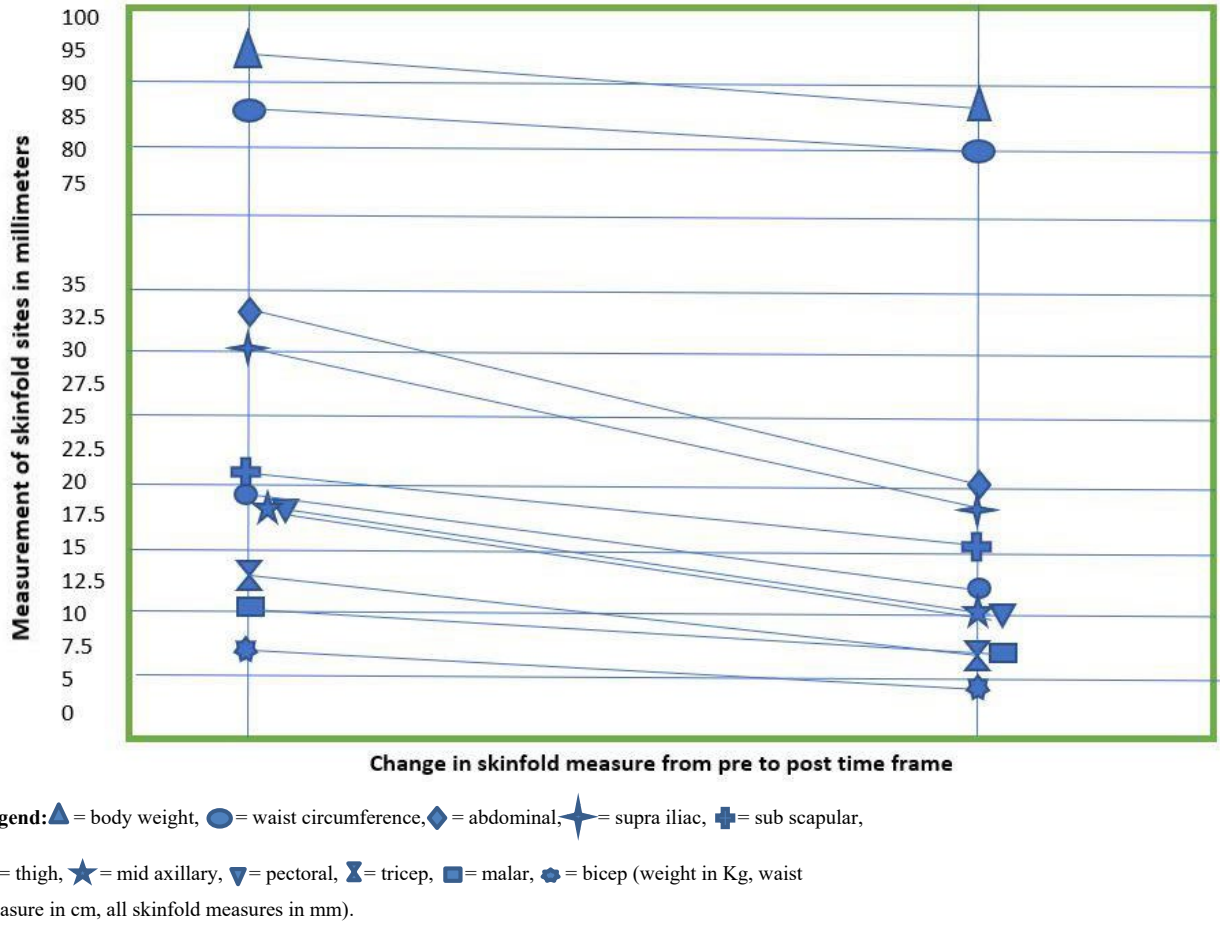

Figure 1: Trends in reductions in body weight and waist circumference (upper lines, P=NS), and reductions in skinfold caliper sites (from high to low-abdominal, supra iliac, sub scapula, thigh, mid axillary, pectoral, tricep, cheek, and bicep, collectively P<0.005).

of sports science since some of the first reports on body composition [15,1,8,2,6,4]. In addition, repeated skinfold measures over time may represent the best methodology for practitioners who seek a high level of direct measurement for the body. The malar measurement is used in specific criteria (as discussed in this report) and is not widely used in fitness and sports medicine. One reason is that clinicians may not see a correlation between a smaller malar cheek measurement vs. whole body skinfold assessments. In this report, the malar measurement (11.1 mm) represented less than half of the average of the eight whole body skinfold measures (20.13 mm).

Study Limitations

The use of skinfold measures has long been the subject of critique in the sports medicine profession due to the high degree of inaccuracy and lack of professional expertise to obtain such measures correctly and repetitively. The trainers at each of the 25 international performance centers are highly trained, skilled professionals who perform thousands of site measurements yearly. However, data points can go unreported or may be overlooked and the same numerical value is reported repeatedly. With the thousands of data points collected for this group, only 6% of total cells went unreported, and 20% of cells reported the same value.

Other limitations such as technician skill was also noted by each performance center trainers since specific techniques should be practiced on different types of client populations. In addition, the lack of the reliability in measurements is noted in the degree of fat thickness (accuracy and precision are poorer in obese individuals), since most skinfolds have a limit of 45 to 60 mm, which decreases their accuracy (plastic models have an even lower accuracy rate). Because measurement accuracy is influenced by skin turgor, hydration status, edema, and skin conditions, body composition could be erroneous. Lastly, prediction equations over time may not apply to the populations being studied, and cross validation of samples may be required before applying the equations.

Physicians and behavioral clinicians find the use of malar measurements a vital component of prepping prior to mandibular surgery since the angle of the zygomatic bone and amount of fat may pose a challenge [14]. In behavioral medicine, the angle and pronouncement of cheek bones has been noted to have a high perceived level of attractiveness. This is enhanced by performing elective surgery. The training methods used by the performance center trainers have a significant impact on the perceived attractiveness of the face in addition to other parts of the body (abdominal area, gluteal, upper arm, and pectoral regions). Staff inherently understands that when clients lose weight–many people will complement them based on weight loss in the facial region. They have developed a measurement tool which could be utilized in health clubs, medical fitness and weight loss centers, as well as physician's offices to track the progress of weight loss programs over time.

Body composition site selection

Body composition skinfold testing at non-traditional sites such as cheek (malar), chin (mandibular), neck, bicep, and patellar is a unique feature of the performance center's assessment protocols. Although the neck and bicep regions (independent of having regression equations used with them [10] have been utilized for body composition, measurements in the cheek area have been studied and published in a variety of journals such as Aesthetic Surgery, Psychology, and Maxillofacial and Oral Surgery [12-14]. It can be speculated that the appearance and shape of the cheek and face regarding weight loss have strong correlations to personal attractiveness, masculinity (both perceived by men and women) and relationships. Shapes and positioning of facial structures through weight loss were measured. 3-D topography [12] and body composition had a direct impact on male masculinity and women's relationship preferences [13].

When considering sports medicine research, both historically and current – the emphasis is mostly on performance, aging, muscle mass, and weight loss. When investigating medical literature, considerations for personal reasons such as attractiveness come into play at a higher level. However, the application of strength training goes beyond aesthetic. A review by Bennie et al states that strength training may be considered the "new frontier" in chronic disease prevention [19].

The performance center using malar measurements is considered to be the worlds' top center for using high intensity strength training. Its application to weight loss was observed early on and now is the cornerstone of its training programs. They have seen success in their clientele for many years. They have also realized that part of weight loss programming is an improved psychological profile, and use behavioral profiles in their training and assessment app.

Because of technological advancements in body composition, utilizing skinfolds has been considered antiquated by some and their use and benefit has been questioned. Besides being a reliable form of body composition testing, they are inexpensive, non-invasive, portable, and their results are well correlated to DEXA and hydrostatic weighing. In addition, and if utilized over time, they can accurately determine subcutaneous fat depositions in any area of the body. The performance center management believes that the correlation of a malar measurement to health is more valuable than just visual inspection. Unlike plastic surgery procedures, where results are temporary and many procedures may be needed to achieve desired outcomes, the performance center understands weight loss is a lifetime commitment. The use of non-traditional skinfolds provides additional information to measure both short term and long-term goals and success.

Conclusion

The use of malar skinfold assessment plays an essential role in assessing total body composition since measurements correlate with conventional body fat sites, and facial fat loss has an impact on overall weight loss. Additionally, facial fat correlates to a higher self-esteem and quality of life, and is a vital component to determining fat removal by surgeons to see best results for both aesthetic and medical reasons.

Furthermore, the use of malar skinfold measurements is an important part of skinfold measures, since it can be used with obesity programs to help delineate with other areas of the body.

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