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Original research

Reliability and Validity of Iranian Slim Guide Skinfold Caliper to Measure Subcutaneous Fat

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ABSTRACT

The aim of this study was to evaluate the reliability and validity of the Iranian slim guide skinfold caliper and the Harpenden skinfold caliper to measure subcutaneous fat. A total of 15 healthy subjects who met inclusion/exclusion criteria were included in the study. The seven-point subcutaneous fat was measured to evaluate the reproducibility of the slim guide skinfold caliper on 2 different days according to Heyward and Wagner instructions. Also, to assess the validity of the slim guide skinfold caliper, the results of subcutaneous fat measurement using the slim guide skinfold caliper were compared with those of subcutaneous fat measurement using the Harpenden skinfold caliper, which is considered as a gold standard method for skinfold measurement. Examiners 1 and 2 demonstrated Good intra-examiner reliability, with high ICC values (ICC=0.95-0.96 and ICC=0.96-0.97 respectively) as a mean of the seven points per day. A good inter-examiner reliability (ICC = 0.93-0.93) was found for the slim guide skinfold caliper on two days. Also, the validity of this method in all seven points was a mean of r = 0.98- 0.97 on two days, indicating an acceptable level of validity. Also, a significant value was acceptable in all tests ($P \leq 0.001$). Therefore, it is recommended that the Iranian slim guide skinfold caliper made in-house can be used for anthropometric measurements, especially in measurements that last more than one day, which is considered as an accurate tool with an acceptable level of validity.

Keywords: Reliability, Validity, Slim Guide Caliper, Harpenden Caliper

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INTRODUCTION

The epidemic of obesity is now considered as one of the most important public health problems facing the world today(1). Obesity can be defined as excessive fat accumulation(2). In fact, the percentage of fat is one of the most important health issues, according to the results from studies, 23.2% of the world adult population is overweight and 9.8% is obese(3). According to the World Health Organization (WHO), the prevalence of obesity is 54% among women and 31 % among men in the Middle East(4-8). Obesity caused by excessive fat accumulation increases both risks of chronic disease and health care costs(9). Therefore, obesity management is an important public health issue(10). There are various ways to measure obesity, one of which is measuring the body fat percentage (BFP)(10-13). Underwater weighing (UWW), ultrasound, bioelectrical impedance analysis (BIA), and dual-energy X-ray absorptiometry (DXA) are among the most common methods of measuring the BFP(10, 14, 15). These methods have high accuracy for measuring the BFP, but they have some limitations such as expensive, lack of simplicity, the failure to perform in the laboratory, non-invasiveness, and the inadequacy in measuring the BFP in large populations(10, 14, 16, 17). The skinfold caliper is a commonly accepted method for measuring the BFP(10, 11).

The skinfold caliper has a calibrated plate and two arms, which are placed on the skin by hand pressure on the lever of movement, and by gradually releasing the hand pressure from the pointer while pushing the caliper arms on the skin, the percentage of fat in millimeters is visible on the calibrated plate. Numerous studies have investigated the BFP(18-21). The skinfold caliper is a non-invasive which indirectly measures the BFP by assessing the amount of subcutaneous fat. This method is composed of two components or compartments and divides the body into fat-free mass and fat mass, and uses the regression equation to calculate the BFP(22, 23). Although the skinfold measurement is a less accurate method than the UWW and DXA, it has advantages such as non-invasiveness, ease to use, portability, no need for special and large space, quick access to results, and lower cost(24-27). One of the most important factors when using an instrument for measuring a variable is its reliability and validity(28). because it should have high accuracy in measurement and can measure the desired variable. In this regard, Jason et al. (2010) evaluated the validity and accuracy of Hand and Lange skinfold calipers. For this purpose, after measuring the BFP in fifty male and female athletes using the Jackson-Pollock's seven-point subcutaneous fat method and DXA and comparing the results, they reported that the self-administered skinfold caliper had poor individual predictive accuracy for the men and the women as compared to the DXA(18). Also, Aandstad et al. (2014) conducted a study on Norwegian Air Force cadets and evaluated intra-examiner reliability and the validity of BIA and DXA to predict body fat. After conducting their study on 39 men and 26 women, they reported excellent reliability (ICC men = 0.96 and ICC female = 0.93) using the Jackson-Pollock's seven-point subcutaneous fat method, and the validity and accuracy of the skinfold calipers (r = 0.88)(29), which is considered as one of the very high values for both the reliability and the validity. Many studies have investigated the reliability and validity of the skinfold calipers using laboratory methods that have been accepted as a reference for measuring body composition and body fat, but as mentioned, the regular use and access to these methods are difficult and costly. In this regard, there are many types of hand skinfold calipers that have been commonly used to measure the BFP. One of these types of common calipers, which is very common to use due to its simplicity, availability, and low cost, is the slim guide skinfold caliper(21, 30). The slim guide skinfold caliper has many applications, however, so far, no studies have been conducted on this model of skinfold caliper and the validity and reliability of the Harpenden skinfold caliper have not been evaluated. This type of caliper has a handle and two metal arms with very good control power and a calibrated plate with a pointer which has a high capability and accuracy in pushing the skin folds. Given that this type of caliper shows higher measurement precision of the amount of fat in millimeters, its use of it requires more experience and expertise(31). Harpenden skinfold caliper is considered as a gold standard method for skinfold measurement with higher accuracy(24, 32). However, no studies so far have investigated the validity and reliability of the slim guide skinfold caliper and the Harpenden skinfold caliper. Given the extensive use of this caliper, it is still not clear whether the slim guide skinfold caliper has good reliability and an acceptable validity to measure the BFP. Therefore, the aim of this study was to evaluate the reliability and validity of the Iranian slim guide skinfold caliper and the Harpenden skinfold caliper in order to measure subcutaneous fat.

METHODOLO

Subjects

A quasi-experimental study was conducted on 15 healthy subjects (males with a mean age of 24 ± 2.29 years, a weight of 77.6 ± 8.28 kg and a height of 178.9 ± 4.68 cm). The study population consisted of all students of Tehran University residing in dormitory who participated in this study through a call to measure the BFP. Prior to the start of the study, all steps of the implementation of the study were presented orally to the participants. All subjects provided written informed consent. The study inclusion/exclusion criteria were specified as follows: male gender, no history of specific disease, no history of cardiovascular disease or gastrointestinal problems diagnosed with a doctor and having no physical activity as a professional athlete.

Procedure

Each subject was asked to be present at a specified time and day to measure the BFP. The anatomical points which included Biceps, Triceps, Subscapular, Iliac crest, Abdominal, Front Thigh and Medial Calf skinfolds were specified based on the instructions of Heyward, Wagner, Lamen et al(29, 33, 34). Using a magic that could be cleaned from the skin of the subjects to reduce the error in measurement, the desired anatomical points were marked(29, 35). After cleaning the skin of the given area, each subject was asked to stand normally in an anatomical position without moving. The BFP was measured using the slim guide skinfold caliper made by internal researchers and the Harponden skinfold caliper(36). In this study, the innovative protocol of Mannion et al. was used to evaluate the reliability(36). First, the first examiner tried to find and mark the anatomical points. Then, he measured the skin fold using both the slim guide skinfold caliper and the Harponden skinfold caliper. After that, the marked marks on the anatomical points related to the skin folds were cleaned and the second examiner tried to find and remark the anatomical points related to the skinfolds and performed the measurements. In the next step, without removing the marks on the skin, the subject returned to the first examiner and once again the measurement was performed to assess the reliability of the measurement from a common mark. This process was repeated for each of the specified skinfolds. Adequate rest time was set between all measurements to prevent the subjects' fatigue. Both examiners had sufficient experience to measure the thickness of the skinfolds using a caliper and they both used the same protocol for measuring skinfolds, in such a way that in the position where the caliper was placed in the examiner's right hand, he stood in front of the subject and using his left thumb, he specified about 1 inch above area and gently pushed it so that separate the skin from the muscle tissue. At this point, the clamps of the caliper were placed on the center of the marked area and the examiner released the handle slowly and gradually with a balanced pressure. The clamps covered the layer separated from the skin and the skin is pushed. Then, after maintaining this position for three seconds, the specified number was read from the caliper and recorded by the second examiner(29, 31). Measurements related to each skin fold were repeated three times using the caliper and their average was recorded as the thickness of the given area(14, 29, 37). Also, all measurements were taken on the right side of the body of the subjects with an accuracy of 0.5 mm(21, 29, 37). The measurement protocol was repeated on the second day at the same time and place to assess the reliability of slim guide skinfold caliper and the Harpenden skinfold caliper.

Statistical Analysis

Statistical analysis was performed using SPSS version 26. A paired t test was used to compare the means of measurements between examiners on two days. Also, the intra-class correlation coefficient (ICC) was used to assess the reliability and a repeated measures ANOVA was applied to compare the results of three measurements of each examiner on 1 day, In this study, ICC values less than 0.1 are indicative of poor reliability, values between 0.1 to 0.3 demonstrated relatively poor reliability, values between 0.3 to 0.5 showed

medium reliability, values between 0.5 to 0.8 was considered as relatively high reliability and values greater than 0.8 were regarded as very high reliability(38). Moreover, Pearson's correlation coefficient was used to find the correlation between the instruments used in this study. A significance level of $\alpha = 0.05$ was considered in this study. The formula SEM= SD $\sqrt{1}$-ICC was also used to calculate the standard error of measurement (SEM).

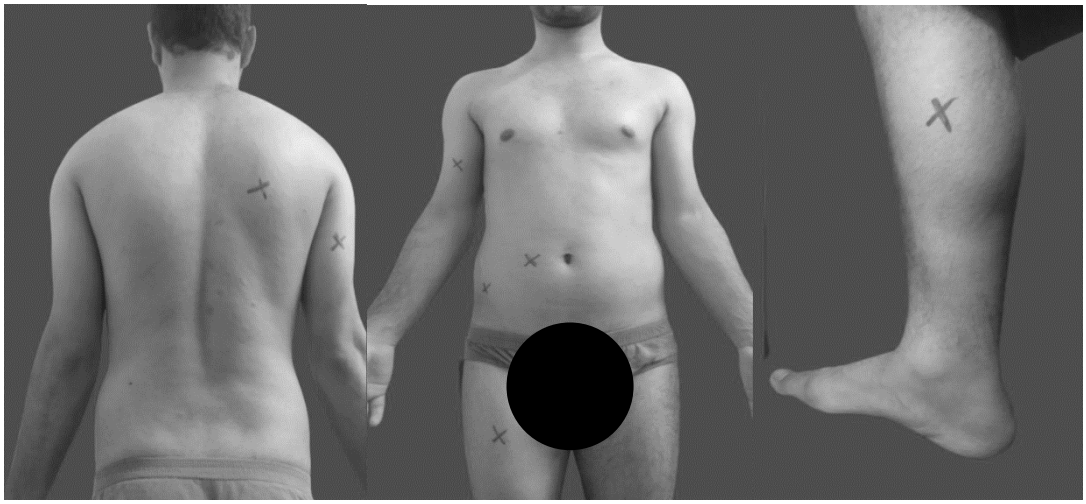

Fig. 1. Anatomical points on body

Fig. 2. Iranian slim guide caliper vs Harpenden caliper

RESULTS

Table 1: Demographic characteristics of the study participants

Sex	Age (year)	Height (cm)	Weight (kg)
Male	24 ± 2.29	178.93±4.68	77.6±8.24

Table 2. Intra-examiner reliability reordered for examiner 1 on the two days.

	The first day				The second day			
Skinfolds	ICC(Confidence Interva1)	P	Measurement Error	Mean	ICC(Confidence Interva1)	P	Measurement Error	Mean
Triceps	0.98 (0.96-0.99)	0.595	3.80	12.11	0.98 (0.96-0.99)	0.818	3.68	12.27
Subscapular	0.98 (0.95-0.99)	0.126	2.87	13.19	0.94 (0.86-0.97)	0.424	2.29	12.74
Biceps	0.89 (0.76-0.95)	0.157	1.09	4.99	0.94 (0.87-0.98)	0.546	1.32	4.83
Iliac crest	0.98 (0.95-0.98)	0.075	3.66	11.01	0.96 (0.92-0.98)	0.126	2.87	11.06
Abdominal,	0.98 (0.96-0.99)	0.424	4.53	16.83	0.98 (0.96-0.99)	0.454	4.35	17.49
Thigh	0.98 (0.97-0.99)	0.122	3.94	15.25	0.97 (0.94-0.99)	0.976	3.76	15.51
Medial Calf	0.96 (0.92-0.98)	0.111	2.06	11.34	0.94 (0.87-0.97)	0.102	2.32	11.93

As shown in Table 2, the ANOVA results of analysis demonstrated that there was no significant difference between the three measurements made by the first examiner on any of the 2 days (P> 0.05). Also, a repeated measures ANOVA was used to detect differences between the examiners and the results showed that no significant difference was observed between three measurements made by the first examiner on 2 days (P> 0.05).

Table 3. Intra-examiner reliability reordered for examiner 2 on the two days**.**

	The first day				The second day			
Skinfolds	ICC(Confidence Interva1)	P	Measurement Error	Mean	ICC(Confidence Interva1)	P	Measurement Error	Mean
Triceps	0.98 (0.97-0.99)	0.638	4.10	12.10	0.97 (0.94-0.99)	0.504	4.03	13.21
Subscapular	0.98 (0.97-0.99)	0.262	2.78	12.22	0.98 (0.95-0.99)	0.773	2.48	11.89
Biceps	0.95 (0.88-0.98)	0.813	1.50	5.23	0.95 (0.90-0.98)	0.294	1.60	5.50
Iliac crest	0.98 (0.96-0.99)	0.121	3.76	11.06	0.97 (0.95-0.99)	0.759	2.98	10.81
Abdominal,	0.97 (0.93-0.99)	0.221	4.62	17.69	0.98 (0.96-0.99)	0.923	4.23	18.04
Thigh	0.98 (0.96-0.99)	0.271	4.28	15.41	0.96 (0.91-0.98)	0.061	3.84	16.12
Medial Calf	0.97 (0.93-0.99)	0.147	3.25	9.81	0.97 (0.95-0.99)	0.061	2.81	10.07

As can be seen from Table 3, the ANOVA results of analysis revealed that no significant difference was found between the three measurements made by the second examiner on any of the 2 days (P> 0.05). Moreover, a repeated measures ANOVA was applied to detect differences between groups and the ANOVA results showed that there was no significant difference between three measurements made by the second examiner on 2 days (P> 0.05)

Table 4. The intra- examiner reproducibility on two days

Skinfolds	Examiner 1					Examiner 2				
	ICC(Confidence Interva1)	P	The Mean of The First Day	The mean of The Second Day	Measurement Error	ICC(Confidence Interva1)	P	The mean of The First Day	The Mean of The Second Day	Measurement Error
Triceps	0.88 (0.64-0.96)	0.798	12.11	12.27	3.50	0.95 (0.87-0.98)	0.201	12.10	13.21	3.98
Subscapular	0.94 (0.82-0.98)	0.186	13.19	12.74	2.54	0.94 (0.83-0.98)	0.306	12.22	11.89	2.54
Biceps	093 (0.80-0.97)	0.322	4.99	4.83	1.19	0.89 (0.69-0.96)	0.303	2.23	5.50	1.49
Iliac crest	0.95 (0.87-0.98)	0.115	11.01	10.42	3.21	0.94 (0.84-0.98)	0.544	11.06	10.81	3.27
Abdominal,	0.96 (0.89-0.98)	0.147	16.83	17.49	4.34	0.97 (0.93-0.99)	0.318	17.69	18.4	4.35
Thigh	0.97 (0.94-0.99)	0.367	15.25	15.51	3.80	0.94 (0.84-0.98)	0.153	15.41	16.12	3.94
Medial calf	0.83 (0.52-0.94)	0.170	11.34	11.93	1.90	0.78 (0.45-0.89)	0.745	9.81	10.07	2.51

As shown in Table 4, the intra-examiner reliability was very high for both examiners on 2 days. Also, the paired t-test results indicated that there was no significant difference between the mean measurements made by each examiner on two days (P>0.05). The paired t-test was used determine the difference in the measurements by each examiner on the two days, and the results showed that there was no significant difference between the assessments of each examiner on 2 days (P> 0.05).

Table 5. Inter-examiner reliability measured on a common anatomical point on the two day

Skinfolds	The First Day			The Second Day		
	ICC(Confidence Interva1)	P	Measurement Error	ICC(Confidence Interva1)	P	Measurement Error
Triceps	0.93 (0.81-0.97)	0.998	3.78	0.97 (0.93-0.99)	0.517	3.82
Subscapular	0.98 (0.94-0.99)	0.360	2.82	0.98 (0.95-0.99)	0.348	2.241
Biceps	0.94 (0.83-0.98)	0.647	1.30	0.93 (0.81-0.97)	0.235	1.46
Iliac crest	0.98 (0.96-0.99)	0.971	3.62	0.96 (0.89-0.98)	0.772	2.88
Abdominal,	0.97 (0.91-0.99)	0.616	4.51	0.99 (0.98-0.99)	0.728	4.24
Thigh	0.94 (0.84-0.98)	0.919	3.96	0.97 (0.92-0.99)	0.665	3.75
Medial calf	0.77 (0.32-0.94)	0.144	2.49	0.73 (0.21-0.91)	0.053	2.25

Table 5 shows the results obtained from the inter-examiner reproducibility marked by each examiner per day. The independent t-test results showed no significant difference was observed between the measurements made by both examiners on 2 days (P> 0.05). Independent t-test was used to determine the differences between the

examiners and the results demonstrated that there is no significant difference between both examiners with respect to measurements made on common anatomical points (P> 0.05).

Table 6. The results of the validity of the Slim Guide skinfold caliper compared to the Harpenden skinfold caliper

	Examiner 1			Examiner 2		
Skinfolds	ICC(Confidence Interva1)	P	r	ICC(Confidence Interva1)	P	r
Triceps	0.98 (0.96-0.99)	0.0001	0.98	0.97 (0.93-0.99)	0.0001	0.96
Subscapular	0.99 (0.97-0.99)	0.0001	0.98	0.99 (0.98-0.99)	0.0001	0.99
Biceps	0.98 (0.94-0.99)	0.0001	0.96	0.98 (0.95-0.99)	0.0001	0.97
Iliac crest	0.98 (0.95-0.99)	0.0001	0.97	0.98 (0.96-0.99)	0.0001	0.98
Abdominal,	0.98 (0.96-0.99)	0.0001	0.97	0.98 (0.96-0.99)	0.0001	0.97
Thigh	0.94 (0.82-0.98)	0.0001	0.88	0.99 (0.98-0.99)	0.0001	0.99
Medial calf	0.96 (0.88-0.98)	0.0001	0.93	0.97 (0.93-0.99)	0.0001	0.96

As can be seen from Table 6, the values of the slim guide skinfold caliper were very close to those of the Harpenden skinfold caliper, indicating that there was a very high correlation between both calipers.

DISCUSSION

The aim of this study was to evaluate the intra- and inter-examiner reliability and the validity of the slim guide skinfold caliper in order to measure subcutaneous fat on two days. The results of the present study showed a very high reliability for the slim guide skinfold caliper measuring the skinfolds. Moreover, when the results obtained from the measurement of skin folds using the slim guide skinfold caliper were compared with those obtained from the Harpenden skinfold caliper, indicating an acceptable level of validity in all seven points. As shown in Tables 2 and 3, the ICC values showed that very high intra-examiner reliability was reordered for each examiner on the 2 days. On the first day, the highest reliability was reordered for examiner 1 (ICC= 0. 98), value related to the triceps, subscapular, iliac crest, abdominal and thigh skin folds, and the lowest reliability value (ICC= 0.89) was related to the biceps skinfold. Also, on the second day, the highest reliability value (ICC= 0.98) was related to the triceps and abdominal skin folds and lowest reliability value (ICC= 0.94) was related to subscapular, biceps and medial calf skinfolds. Similarly, the highest reliability value (ICC = 0.98) for the skin folds of triceps, abdominal, iliac crest, and thigh was reordered for examiner 2 on both days, and the lowest reliability value ICC= 0.95) was related the biceps skin fold, and on the second day, the highest reliability value (ICC= 0.98) related to subscapular and abdominal skin folds and the lowest reliability value (ICC= 0.95) was related to abdominal skinfold. As can be seen from Table 4, the high intra-examiner reliability was reordered for both examiners on two days. The highest reliability value (ICC= 0.97) related to thigh skin fold was obtained for both examiners. The lowest reliability value for both examiner 1 (ICC= 0.83) and examiner 2 (ICC= 0.78) was related to medial calf skinfold. These results are consistent with those of a study conducted by Aandstad et al. (2014) evaluating reliability and the validity of BIA and the Harpenden skinfold caliper to predict body fat in military personnel (including 39 men and 26 women)(29). Similar to our study, Jackson-Pollock's seven-point subcutaneous fat method was used for the skinfold measurements(39). In the study, the examiner recorded the amount of fat thickness at each point in such a way that each anatomical point was measured twice, and if the difference between the two measurements performed by the Harpenden skinfold caliper was more than 0.2 mm, the third measurement was performed and the average of three measurements was recorded as the thickness of the skin fold. After analyzing the results of the reliability of Harpenden skinfold caliper via the ICC, the reliability of the Harpenden skinfold caliper measuring the thickness of skin

folds was reported to be 0.96 for male sand 0.93 for females, indicating very high reliability value. In the study, one of the possible causes of high reproducibility is that the Harpenden skinfold caliper is used to measure the skinfold thickness, which differs from other calipers in terms of pressure distribution on the skin. Is also one of the most accurate skinfold calipers used to measure the skinfold thickness. In addition, the study was performed on a large sample size (n= 65) and when the sample size is large, the variability of the results can decrease(40). In addition, high reliability in the study may be due to the study population consisted of military personnel who had normal fit body and variability in fat amount was observed in them.

Another result of the present study was the inter-examiner reliability to measure the skin fold thickness between the values obtained by them in two consecutive days and measurement made on a common anatomical point. As shown in Table 5, regarding the reliability value between the two examiners based on a common anatomical point, the highest reliability value (ICC= 0.98) was related to the subscapular and iliac crest skinfolds and the lowest reliability value (ICC= 0.77) was related to the medial calf skinfold on the first day and the highest reliability value (ICC= 0.97) was related to subscapular skinfold and the lowest reliability value (ICC= 0.73) was related to medial calf skinfold on the second day, indicating a very high reliability value. Also, the independent t-test results demonstrated that no significant difference was observed in the skin fold measurements for any of the anatomical points measured by two examiners on a common anatomical point (P> 0.05). Accordingly, it seemed that when both examiners measured based on the anatomical point by one of the examiners who had more experience in identifying anatomical points, the probability of error decreased and the probability of the same results increased because in the process of performing the measurement, when each of the examiners identified the anatomical points and measured separately them , the probability of error was higher because the probability that both examiners could correctly and equally identify anatomical points was low.

In their study Kisspert and Merrifield demonstrated that the inter-examiner reliability value of skinfold caliper to measure skinfold thickness was reordered ICC= 0.80- 0.85 for males and ICC= 0.62-0.75 for females, indicating relatively high reliability for males, which was consistent with our results but the reliability value was relatively low for females(40), which was inconsistent with our results. The low inter-examiner reliability among females in the study may be attributed to the gender difference because women generally have a higher body fat percentage than men, in addition, in the study, the anatomical points was selected to measure the skinfold thickness of in females, including the abdominal and suprailiac areas, where fat accumulation is higher.

In the present study, when two examiners measured based on a common anatomical point that was identified and marked by only one of them, a very good reliability was obtained. Given that in measurements using skinfold caliper especially when the sample size is large and the study is performed by two examiners, there is no need to clean and find and mark the anatomical points by both of them, which can cause a loss of time and reduce the accuracy of measurement.

Another variable assessed in this study was the validity of the slim guide skinfold caliper, which, like the reliability of this caliper model, had not been investigated in any study so far. The results of Pearson correlation coefficient showed that for examiner 1, the highest validity value (r= 0.98) was related to triceps, subscapular skinfolds and the lowest validity value (r= 0.93) was related to medial calf skinfold. Also, for the examiner 2, the highest validity value (r= 0.99) was related to subscapular and thigh skinfolds and the lowest validity value (r= 0.96) was related to medial calf skinfold. This level of validity is very high according to the Harpenden skinfold caliper, which is considered as the gold standard. This result is consistent with Kashef et al.' study, evaluating the validity of digital skinfold caliper and the Harpenden skinfold caliper (r= 0.89)(35). According to the results of the present study, the high reliability value and acceptable validity level of the skinfold caliper may be due to the expertise and high experience of two examiners in identifying anatomical points related to skin folds and the correct use of caliper to measure the skinfolds. Also, the slim guide skinfold caliper is designed in such a way that it makes measurements simple and easy many times, unlike other calipers, such as digital and Lange skinfold calipers, there is a possibility of errors as well as difficulty in accurate assessment of the results due to the complexity and different design of the caliper plate, which may be one of the possible

reasons for its acceptable validity in this study. Other factor contributing to high reliability of slim guide skinfold caliper are the absence of wide differences as well as the relative integrity in terms of body type of the research subjects and the fact that all subjects have a low body fat percentage, leading to the mean measurements be close to each other. In addition, in this study, of the skinfold measurements were performed on two days at a specific time and place, which could reduce the amount of systematic error made by the examiners. Moreover, the anatomical points to measure the skinfolds were selected in such a way that they could assess the accumulation of fat in almost the whole body. All of these factors can contribute to obtaining the high reliability value and acceptable validity level of the Iranian slim guide skinfold caliper.

CONCLUSION

The results of the present study demonstrated that the slim guide skinfold caliper, which is commonly used due to its ease to use, low price, non-invasiveness and portability, is an instrument with very high repeatability and acceptable validity to measure skinfolds in males. Therefore, it is recommended that this device can be used for anthropometric measurements in order to the BFP, especially in measurements that last more than one day.

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چکیده فارسی

بررسی تکرارپذیری و اعتبار کالیپرچربی سنج مدل اسلیم گاید ایرانی در اندازه‌گیری چربی زیرپوستی

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هدف از مطالعه حاضر بررسی تکرارپذیری و اعتبار کالیپر چربی سنج مدل اسلیم گاید ایرانی با کالیپر هارپندن در اندازه‌گیری چربی زیر پوستی بود. تعداد ۱۵ نمونه مرد سالم با در نظر گرفتن معیارهای ورود و خروج تحقیق در پژوهش حاضر شرکت نمودند. اندازه‌گیری چربی زیر پوستی جهت بررسی تکرارپذیری کالیپر اسلیم گاید به صورت ۷ نقطه ای براساس دستورالعمل هیوارد و واگنر در 2روز متفاوت صورت گرفت همچنین جهت بررسی اعتبار این وسیله نتایج حاصل از اندازه‌گیری چربی زیر پوستی با استفاده از کالیپر اسلیم گاید با نتایج حاصل از کالیپر چربی سنج هارپندن که استاندارد طلایی در اندازه گیری چربی زیر پوستی در میان کالیپرها می‌باشد مورد مقایسه قرار گرفت. نتایج حاصل از پژوهش تکرار پذیری بالا و خوبی را در تکرار پذیری درون آزمونگر ICC =۰/۹۵-۰/۹۶ به صورت میانگینی از ۷ نقطه در هر روز برای آزمونگر اول و ICC =۰/۹۶-۰/۹۷ برای آزمونگر دوم و تکرار پذیری بین دو آزمونگر ICC =۰/۹۳-۰/۹۳ بین 2 روز برای کالیپر اسلیم گاید نشان داد. همچنین اعتبار این وسیله نیز در هر هفت نقطه به صورت میانگین r = ۰/۹۸-۰/۹۷ در دو روز اندازه‌گیری بود که بیانگر ارتباط خوب و قابل قبول می‌باشد. همچنین در تمامی آزمونها مقدار معنی داری قابل قبول بود($P\leq$ ۰/۰۰۱) . از این رو استفاده از کالیپر چربی سنج مدل اسلیم گاید ساخت محققین داخلی در اندازه‌گیری های آنتروپومتریکی مربوط به سنجش چربی بدن به ویژه در اندازه‌گیری هایی که بیش از یک روز به طول بیانجامد به عنوان وسیله ای دقیق و با اعتبار بالا توصیه می‌شود.