Scientific Research and Essays Vol. 7(31), pp. 2827-2834, 9 August, 2012
Available online at http://www.academicjournals.org/SRE
DOI: 10.5897/SRE12.254
ISSN 1992-2248 ©2012 Academic Journals

Full Length Research Paper

A statistical analysis on skinfold thickness and measurement of body composition for Chinese adults

He Ye[1], Hai Xiangjun[1], Bai Jingya[1], Wang Jing[2], He Jinquan[1], Wang Yutang[1] and Xi Huanjiu[3]*

[1]Faculty of Medicine, Northwest University for Nationalities, China.
[2]Centre for Modern Languages and Human Science, University Malaysia Pahang, Malaysia.
[3]College of Anatomy, Liaoning Medical University, China.

Accepted 30 May, 2012

The purpose of this study was to evaluate developmental mechanism and characteristics of skinfold thickness and body composition among Chinese adults of Han nationality. Sampling measurement method was applied to acquire the indexes of height, weight, cheek skinfold thickness, triceps skinfold thickness, biceps skinfold thickness, subscapular angle skinfold thickness, anterior superior iliac spine skinfold thickness and gastrocnemius skinfold thickness in the area of Lanzhou, Pingliang, Wuweiin Gansu Province among Chinese adults of Han nationality. The body composition is estimated by standard statistical BMI value in accordance with Guideline for Overweight and Obesity Prevention and Control in Chinese adults (Trial), and Japanese Changling formula and the Brozek formula. This study analyzed skinfold thickness and measurement of body composition of Chinese adults of Han nationality. The findings suggested that adults should pay attention to adjusting their structure diet, and do more physical activities to reduce the incidence of obesity-related diseases in Lanzhou, Pingliang and Wuwei.

Key words: Han nationality, skinfold thickness, body composition.

INTRODUCTION

A recent editorial in this journal noted the inability of classical measures of growth and development to meet the requirements of modern clinical medicine and research, and suggested that measurement of body composition could meet these requirements (Davies, 1994). During the growth process of the human body, skinfold thickness is an important indicator for the evaluation of individual development and nutritional status. The development of human skinfold thickness (subcutaneous fat) is affected by genetic factors, sex hormones and neuroendocrine activity. In addition, there are obvious regional difference, ethnic differences, eating habits, nutrition and physical exercise etc (Huang et al., 2007).

A well-known and widely applied model for studying body composition in humans is the two-component model (Lukaski, 1987). This model divides the human body into two components, one consisting of pure fat (fat mass) and one consisting of all non-fat material (fat-free mass). The basis of the two-component model stems from results of cadaver analyses (Garrow, 1983). Measurement of body composition is proving increasingly important in clinical nutrition and research. Skinfold thickness is a simple means of estimating body composition which is widely used in various people, but there is little information on Chinese adults of Han nationality.

Knechtle et al. (2011) investigated the association between skinfold thickness and race performance in male and female Ironman triathletes. Skinfold thickness at 8 sites and percent of body fat was correlated with total race time including the split times for the 3 sub disciplines, for 27 male and 16 female Ironman athletes. The results of this study indicate that low skinfold

*Corresponding author. E-mail: jingyabai@gmail.com.

thicknesses of the upper body are related to race performance in male Ironman triathletes, but not in females. In Esco et al. (2011b), the purpose of their study was to determine if heart rate recovery (HRR) and heart rate variability (HRV) are related to maximal aerobic fitness and selected body composition measurements. The results of this study suggest that cardiovascular autonomic modulation is significantly related to maximal aerobic fitness and body composition. Esco et al. (2011a) did a study to determine if resting HRV is related to maximal aerobic fitness and the selected body composition measurements as follows: body mass index (BMI), waist circumference (WC) and the sum of skinfold thickness (SUMSF). This study showed the importance of the simple technique of measuring skinfold thickness in relation to cardiovascular autonomic control of heart rate. The HRV [Latin capital V with dot above] parameters analyzed in this study (that is, HFnu and LF:HF) were significantly related to SUMSF, but not o2max, WC, or BMI. The skinfold technique is a commonly used field measure for predicting percentage of body fat. Therefore, training exercise should perhaps induce an improved body fat mass to appreciably augment cardiovascular autonomic modulation.

China is a multi-ethnic country, and Han Nationality is the main body nationality in China. According to the sixth national census in 2010 Data Bulletin (No. 1), until November in 2010, Han Nationality population reaches more than 1,200,000,000, accounting for 91.51% of the population of China. At present in China, researches on children, youths, minorities and skinfold thickness are more fruitful (Xiao and Xi, 2009; Xu et al., 2000; Liu et al., 2009; Zheng et al., 2003, 2004; Suo et al., 2005).

However, actually studies are few (Wang et al., 2011); while the population of Han Nationality is majority in China. Therefore, this article has conducted the research on skinfold thickness in Han Nationality adults.

METHODS

The survey and sampling methods

This study focused on Han Nationality in Gansu Province. Gansu is one of the traditional settlements and birthplaces of Han Nationality in China. According to the sixth national census data Gazette of Gansu Province in 2010, the resident population was 25,575,254 in Gansu Province. Among them, the population of Han Nationality was 23,164,756, accounting for 90.57%. In this study, the research subjects were Chinese adults of Han Nationality in Lanzhou, Pingliang, and Wuwei of Gansu Province. The random cluster sampling method was used for the target participants population.

1500 potential participants, above 20 years old, called a research assistant who then screened them for eligibility as well as collecting basic demographic information. Demographic characteristics will be collected during initial screening, including country of birth, language spoken, level of education, regular menstrual cycle, if any government pensions/benefits are received, living situation and total time spent in a car as a driver or passenger each week. In addition, data on any medical conditions and medication used will be collected through the medical clearance forms participants fill out prior to commencing the study. Potential participants were residents for a long time. The excluded participants had incomplete material and data, and also patients with some problems of the physical development. In the end, there are validly sample of 1407 people, including 700 men and 707 women.

This ongoing analysis continued with interview data thus organized into different sets of working charts. Two participant themes emerged while transcribing the recorded interviews and were verified using researcher reflections and the individual and collective organizing charts. Through this process, it became apparent to the researcher that self-care and community constituted participant-emergent themes which participants appeared to find compelling.

The survey content and methods

Measurement standards are in accordance with national standards of the People's Republic of China in 1985. The methods of measurement and controlling quality are in accordance with "anthropometry" of Xi and Chen (2010). The measurers have carried out strict training, and if the test of small-sample pre-survey fails, they will lose the chance to the formal investigation. Measurement data include height, weight, skinfold of the cheek, right arm, triceps skinfold, arm brachial biceps bit skinfold, subscapular angle skinfold, skinfold anterior, superior iliac spine, and gastrocnemius skinfold. All the data of measurements were average in continuous measurements three times, and body mass index (BMI) and body fat (BF%) for evaluation of medical conditions were calculated.

Height: standing and sitting height in meters was used as the instrument for measurement with marking off in centimeters. Subjects were asked to take off his shoes and hats, stand on the floor at attention, hang hands down naturally, bring heels closer together, stand with toes apart to about 45 degrees; they were asked to use their heels, hips and shoulders to close up the column, and the trunk was where they were asked to naturally hold themselves upright; the two eyes were asked to be leveled to the front. Moreover, the examiner was asked to stand in the right side of the measuring board, and gently moved the slide until it got to the head point. The measurement error shall not exceed 0.5 cm.

Weight: the instrument of the leverage scale was used for the weight measurement in kilograms. The subjects were asked to deplete urine and underwear, and were asked to wear underwear, stand over in the middle of the weighing platform with bared feet. Their hands did not touch other objects, and the counterweight was adjusted until the leverage was balanced; and the data were recorded to the smallest scale. And the test error was not more than 0.1 kg.

Skinfold thickness measurements: the Imitation Japanese Rong Yan type modified skinfold thickness gauge was used as skinfold thickness meter. The measured instrument was strictly calibrated before measuring skinfold thickness. Surveyors were disciplined by a professional trainer in order to control strict quality. And all of the testing errors should not exceed 0.5 mm. Skinfold measurement methods are as follows:

(1) Skinfold thickness in the cheek: the thumb was fixed on the corners of the mouth outside of subjects and the index finger was asked to point at the ear lobe. The distance of the two fingers is about 3 cm. and the two fingers were asked to pinch the skin and subcutaneous tissue.
(2) Skinfold thickness in the three-headed muscle of the right arm: Taking the midpoint of the right upper arm acromion points and olecranon, and the direction of the skinfold paralleling with the direction of the long axis of the arm.
(3) Skinfold thickness in the biceps of the right arm: in the biceps of the right upper arm, the medial side of the upper arm, the horizontal

position of the midpoint of the acromion and the radial in direction of the skinfold paralleling with the long axis of upper arm.
(4) Skinfold thickness in subscapular angle: Taking the bottom of the subscapular angle, the skinfold direction is downward biased outside the 45° angle.
(5) Skinfold thickness in anterosuperior iliac spine: Taking the top of the anterosuperior iliac spine, the skinfold direction is downward biased inside the 45° angle.
(6) Skinfold thickness in gastrocnemius: taking the medial side of the maximum horizontal circumferences in the short leg, and the direction of the skinfold paralleling with the direction of the long axis of the short leg.

Data processing

Every 10-year of age was considered as an age group. The samples were divided into five age groups such as 20-29, 30-39, 40-49, 50-59, above 60. The formulas used for measuring BMI and BF % (Brozek, 1963) were as follows:

$$BMI = \text{body weight (kg)} / \text{height (m)} \quad (1)$$

$$BF\% = [(4.570 / D) - 4.142] * 100\% \quad (2)$$

Where D is the body density (Brozek, 1963). It is calculated by the regression equation, which is proposed by a Japanese scholar, Changling. Normally, $D=1.0913-0.00116 \cdot X$ for male, and $D=1.0897-0.00133 \cdot X$ for female. (X = scapular angle, skin fold thickness (mm) + triceps skin fold thickness (mm)) (Chen, 1993).

RESULTS

Skinfold thickness analysis among Chinese adults of Han Nationality in Gansu

Primary analysis will be via intention-to-treat with all samples including regardless of dropout or level of adherence. Missing data will be imputed according to the maximum likelihood expectation algorithm via the Statistical Package for the Social Sciences (IBM©, SPSS Version 19.0 Excel 2003). Data will be presented as the mean ± standard deviation or median and range, as appropriate.

Analysis for male: compared with six indexes of skinfold thickness in Table 1, the values of subscapular skinfold thickness are the highest in Pingliang and Lanzhou. In addition, the anterior superior iliac spine position, triceps muscle, cheek, gastrocnemius skinfold are ranked the second. And values of biceps skinfold thickness are the lowest in Pingliang and Lanzhou. In Wuwei, the results of subscapular skinfold thickness and biceps skinfold thickness are same with that of Pingliang and Lanzhou. However, the values of triceps skinfold thickness are greater than the anterior superior iliac spine.

Analysis for male: compared with six indexes of skinfold thickness in Table 1, in Gansu, female adults also have some similar features, where values of subscapular skinfold thickness are the highest and values of biceps skinfold thickness are the smallest.

However, for others with four indexes of skinfold thickness, there are some different features compared with males' results. In detail, in Lanzhou, four indexes of skinfold thickness of female were ranked as the anterior superior iliac epithelial fold> triceps skinfold> cheek skin folds> gastrocnemius skinfold. In Pingliang, four indexes of skinfold thickness of female were ranked as triceps skinfold > anterior superior iliac epithelial folds> gastrocnemius skinfold> cheek skinfold. In Wuwei, four indexes of skinfold thickness of female were ranked as triceps skinfold> anterior superior iliac epithelial fold> cheek skin folds> gastrocnemius skinfold.

In the same area, compared with six indexes of skinfold thickness in the same age group, the mean values of female six indexes of skinfold thickness are higher than that of male. In addition, t-test is used for evaluating 90 pairs of data. There is no evident difference ($p> 0.05$) in the subscapularis and the anterior superior iliac spine of 20-age group in Lanzhou and Pingliang and in the anterior superior iliac spine of 30-age group in Pingliang. There are evident differences ($p <0.05$) in the biceps of 20-age group and the anterior superior iliac spine of 40-age group in Lanzhou. However, there is no significant difference in the other data ($p <0.01$).

Results of aging changes and skinfold thickness among adults of Han Nationality

From Figure 1, in Lanzhou, the relationship between male subcutaneous fat thickness and aging can be described as follows. The subcutaneous fat is accumulated gently from 20-age group. And then, in 50-age group, the thickness reached a peak and it begins to thin after 50 year old group. In Pingliang, the trend of subcutaneous fat thickness was stable and decreased slowly. The lowest value is 50-age group. In Wuwei, the subcutaneous fat is accumulated gently from 20-age group. And then, in 40-age group, the thickness reached a peak and it begins to thin after 40 year old group. Overall, the subcutaneous fat thickness of Lanzhou male was significantly higher than Pingliang and Wuwei in every aging level. (Except in the 20-age group, Lanzhou male was slightly lower than Pingliang male). In Wuwei, male subcutaneous fat thickness is higher than the Pingliang male between 30 to 59 age group, but other age groups were lower than Pingliang male. In t-test, there are significant differences ($P <0.05$) between the skinfold thickness values of Lanzhou male and Wuwei male in 20-age group, and between that of Pingliang male and Wuwei male. There is significant difference ($P <0.05$) between skinfold thickness values of Lanzhou male and Pingliang male in 40-age group. There is difference ($P <0.01$) among skinfold thickness values of Lanzhou male, Wuwei and Pingliang male in 50-age group. There is difference ($P <0.01$) between skinfold thickness values of Lanzhou male and Wuwei male in 60-

Table 1. The results of body composition and six index of skinfold thickness of Han nationality in Gansu ((x± S) mm).

Index	Age	Samples	Cheeks skinfold	Biceps skinfold	Triceps skinfold	Subscapularis skinfold	Anterior skinfold	Gastrocnemis skinfold	BMI	BF%
Male in Lanzhou	20～	40	6.44±2.45	5.54±3.36	8.84±4.34	14.80±6.58	13.40±7.46	8.94±3.25	22.54±3.27	15.42±5.04
	30～	40	8.57±4.01	5.49±3.29	8.66±4.48	16.98±8.67	12.72±6.44	7.45±3.27	24.09±3.14	16.38±5.99
	40～	40	9.86±5.02	6.22±3.99	10.19±5.32	18.27±8.65	14.19±8.03	8.02±4.08	24.47±4.12	17.72±6.41
	50～	40	10.37±3.69	6.28±2.59	10.34±4.30	19.54±7.50	13.73±6.08	8.27±6.07	24.81±3.00	18.36±5.14
	60～	40	9.96±3.11	5.45±2.08	9.40±3.41	16.60±5.76	12.18±5.36	6.97±3.48	24.54±3.14	16.50±3.78
	Total	200	9.04±3.99	5.79±3.12	9.49±4.42	17.24±7.61	13.24±6.71	7.93±4.18	24.09±3.42	16.88±5.40
Female in Lanzhou	20～	40	11.71±3.09	6.90±2.37	13.85±4.64	17.37±7.63	13.60±6.94	12.00±3.70	20.48±2.35	21.87±5.93
	30～	40	13.28±3.63	8.78±4.16	17.97±6.32	22.25±8.87	18.45±8.94	12.71±5.59	24.80±4.03	26.98±8.34
	40～	40	13.75±3.48	8.76±4.38	19.36±6.36	24.33±8.62	18.54±8.01	13.67±4.58	24.59±2.78	28.95±8.07
	50～	45	14.31±3.75	10.81±3.95	19.84±5.97	25.46±7.65	22.02±7.42	13.45±5.35	24.90±3.47	29.84±7.22
	60～	41	13.85±3.94	9.70±4.24	17.42±4.79	25.55±7.59	21.05±7.48	12.67±4.46	26.01±3.24	28.49±6.56
	Total	206	13.40±3.67	9.04±4.07	17.74±6.00	23.06±8.56	18.82±8.24	12.91±4.79	24.18±3.72	27.29±7.74
Male in Pingliang	20～	50	6.94±3.61	4.82±2.80	9.22±5.57	14.75±7.03	11.82±6.82	8.58±4.27	22.58±3.03	15.58±5.53
	30～	50	7.72±3.83	4.65±2.35	8.81±4.95	14.79±7.54	11.65±7.61	7.73±4.48	23.02±3.26	15.41±5.76
	40～	50	7.65±3.41	4.40±2.36	8.84±4.75	13.87±6.89	9.66±5.81	6.42±3.54	23.21±3.31	14.99±5.31
	50～	50	7.85±3.80	3.92±2.02	7.53±3.86	13.94±8.07	8.38±5.32	5.72±3.29	22.40±3.95	14.41±5.47
	60～	50	9.85±4.56	4.74±3.02	8.55±4.81	14.14±7.08	8.59±4.98	5.92±2.33	22.42±3.04	14.98±5.33
	Total	250	8.00±3.95	4.51±2.54	8.59±4.81	14.30±7.29	10.02±6.31	6.89±3.80	22.73±3.32	15.08±5.45
Female in Pingliang	20～	50	11.49±3.72	6.67±2.76	17.03±5.56	17.11±6.00	13.19±6.17	12.51±4.87	22.71±3.00	23.49±5.98
	30～	50	12.36±3.59	7.83±3.58	17.67±5.65	20.24±7.31	13.86±7.13	13.29±4.15	22.87±2.90	25.62±6.35
	40～	50	11.54±4.26	7.67±2.93	17.41±5.20	21.12±6.97	15.04±7.12	12.52±3.96	24.24±3.03	25.97±6.28
	50～	50	12.30±3.78	8.48±4.45	18.01±6.19	21.70±8.43	17.14±8.38	12.29±5.30	24.36±3.71	26.68±7.70
	60～	52	13.05±5.19	9.20±5.24	18.22±7.09	20.67±10.06	14.78±9.39	13.22±6.99	24.81±4.24	26.27±9.49
	Total	252	12.15±4.17	7.98±3.98	17.67±5.95	20.17±8.00	14.80±7.79	12.77±5.16	23.61±3.58	25.61±7.32

Table 1. Contd.

Male in Wuwei	20～	50	6.34±2.41	3.78±1.66	8.15±3.39	10.62±5.27	5.72±2.24	6.31±2.21	20.20±2.55	13.12±3.58

	30～	48	7.81±2.98	4.96±2.25	8.97±4.05	14.21±5.85	9.61±4.57	6.67±3.40	23.68±2.83	15.19±4.43
	40～	50	8.64±4.42	4.68±1.96	9.42±4.98	15.48±6.99	8.51±5.67	5.81±3.01	23.81±2.94	16.01±5.22
	50～	50	7.60±3.65	4.40±2.17	7.78±4.23	13.53±5.61	7.11±3.36	5.29±2.25	23.13±3.11	14.31±4.28
	60～	50	7.43±3.31	4.12±1.61	7.20±3.28	13.20±6.37	6.76±3.29	5.11±2.53	22.99±2.82	13.89±4.24
	Total	250	7.56±3.47	4.39±1.98	8.31±4.08	13.41±6.21	7.54±4.20	5.84±2.76	22.76±3.13	14.51±4.46
Female in Wuwei	20～	50	13.17±3.44	7.50±2.77	15.50±4.89	16.07±5.52	10.78±3.95	13.08±4.38	20.67±2.42	22.06±5.50
	30～	50	12.99±6.65	7.97±3.61	16.59±6.42	18.59±8.19	12.75±6.45	11.88±5.73	23.11±3.52	24.13±7.76
	40～	50	11.88±4.15	9.06±4.00	17.24±5.19	21.79±6.35	15.20±6.08	12.42±6.08	24.97±3.03	26.23±5.85
	50～	50	12.69±4.20	9.13±3.97	18.40±5.52	23.52±7.94	15.43±7.61	12.11±5.39	24.75±3.06	27.91±7.00
	60～	49	12.82±4.53	8.81±3.46	17.65±6.38	21.56±8.01	14.19±6.53	11.87±6.15	24.58±3.23	26.38±7.48
	Total	249	12.53±4.13	8.49±3.62	17.07±5.75	23.30±7.69	13.67±6.43	12.27±5.55	23.61±3.45	25.34±7.02

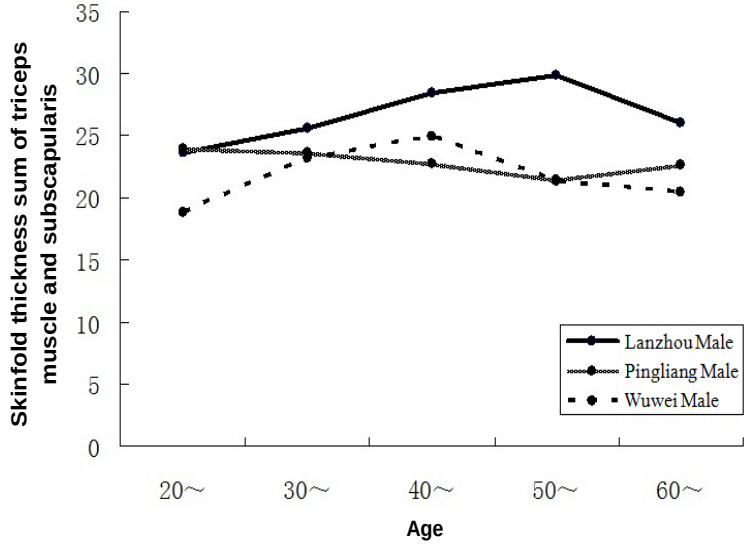

Figure 1. Male comparison of the skinfold thickness sum of triceps muscle and subscapularis.

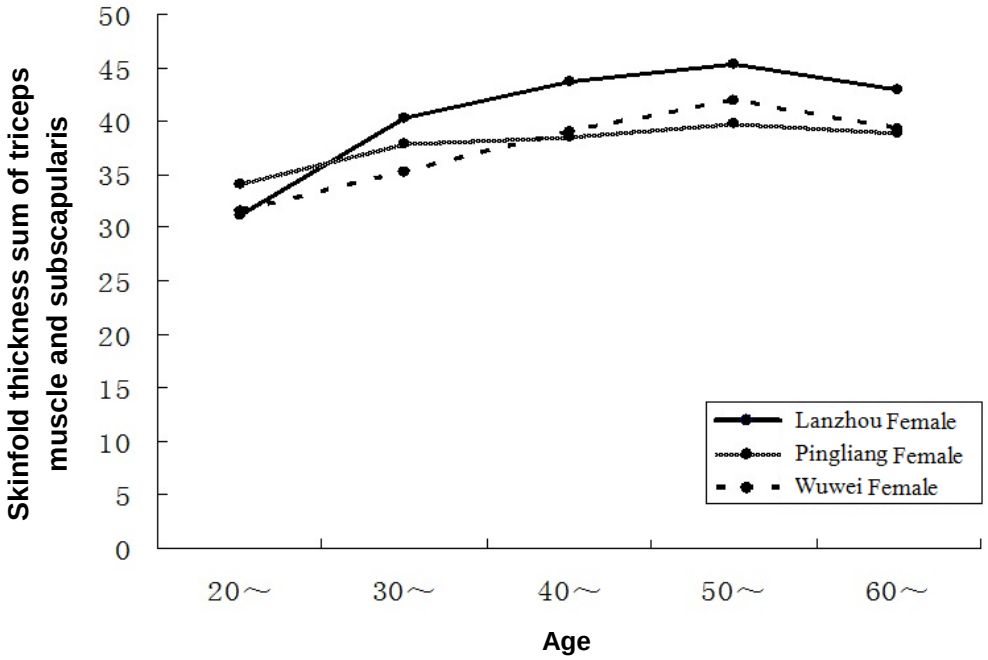

Figure 2. Female comparison of the skinfold thickness sum of triceps muscle and subscapularis.

age group.

Figure 2 shows that the changes trend of female skinfold thickness is almost similar in every age group. The subcutaneous fat is accumulated gently from 20-age group. And then, in 50-age group, the thickness reached a peak and it begins to get thin after 50 year old group. Overall, the subcutaneous fat thickness of Lanzhou female was significantly higher than Pingliang and Wuwei in every aging level. (Except in the 20-age group, Lanzhou male was slightly lower than Pingliang male). In t-test, there is significantly difference ($P<0.05$) between skinfold thickness values of Lanzhou female and Pingliang female in 40 and 50-age groups.

Results of body composition among adults of Han Nationality

According to the Chinese adult overweight and obesity prevention and control guidelines (Trial) by the Disease Control Division of the Ministry of Health announced in 2003, BMI of above 24 is the overweight boundary for Chinese adults, and BMI value of above 28 is the obese boundary for Chinese adults. The statistics results derived from the overall analysis are shown as follows. In Lanzhou, overweight male accounts for 36% and obesity male accounts for 14%; overweight female accounts for 31.5% and obesity female accounts for 14%. In Pingliang, overweight male accounts for 25.7% and obesity male accounts for 6.43%; overweight female accounts for 31.5% and obesity female accounts for 9.52%. In Wuwei, overweight male accounts for 27.42% and obesity male accounts for 5.24%; overweight female accounts for 31.73% and obesity accounts for 11.24%.

Analyzing the proportion of overweight and obesity analysis in every age group, Lanzhou adults and Pingliang females are the lowest proportion of overweight and obesity in 20-age group, and the highest proportion of overweight and obesity after 50 years old. In addition, Pingliang males are similar in proportion of overweight and obesity in every age group. Wuwei adults are the lowest in proportion of overweight and obesity in 20-age group, and the highest in proportion of overweight and obesity after 40 years old.

The comparison between male and female body fat index in same area and age group is as follows. There is a significant difference ($p <0.01$) between male and female body fat index, and the body fat index of female is higher than that of male. The body fat index of Lanzhou male increases from 20-age group. And then, in 50-age group, the index reaches the peak and it begins to get thin after 50 year old group. However, even the body fat index in 60-age group is higher than 20-age group, with almost 1.08%. The body fat index of Pingliang male decreases from 20-age group. And then, in 50-age group, the index reaches the bottom and it begins to get thick after 50 year old group. The body fat index in 60-age group is lower than 20-age group, with almost 0.6%. The body fat index of Lanzhou male is increased from 20-age group. And then, in 40-age group, the index reaches the peak and it begins to get thin after 50 year old group. The Body fat index in 60-age group is higher than 20-

age group, with almost 0.77%.

In addition, the changes trend of female body fat index is almost similar in every age group. The subcutaneous fat increased gently from 20-age group. And then, in 50-age group, the body fat index reached a peak and began to get thin after 50 year old group. However, the body fat index in 60-age group was higher than 20-age group. The trend is similar to the skinfold thickness in Figures 1 and 2.

DISCUSSION

The investigation studied skinfold thickness and body composition among Chinese adults of Han Nationality. There are some conclusions as follows. Skinfold thickness of the cheek can generally reflect the development status of the head and facial subcutaneous fat, triceps, biceps, and gastrocnemius skinfold thickness generally reflects the status of the development of the limbs, subcutaneous fat. Subscapularis bit and anterior superior iliac spine leather fold thickness can generally reflect the status of the development of trunk subcutaneous fat (Suo et al., 2005). In Gansu, there are some similar characteristics in males and females of Han Nationality. The development of trunk subcutaneous fat is better than the limbs, and back fat is the thickest. The development of facial subcutaneous fat is moderate. In the same age group, the six indexes offemale skinfold thickness and body fats were higher than that of male.

In comparison among the three areas, the skinfold thickness in Lanzhou adults is greater than that of Pingliang and Wuwei adults. There are two reasons for this interesting phenomenon. One, it could be due to the large and frequent intake of meat, eggs, milk and high-fat to high-protein food in the diet of Lanzhou residents. Two, the reason may be because of the modernization of urban life, and convenient transportation, with little exercise being done. The Pingliang residents worked in agriculture-based activities, with high physical exertion and low living standard. Males involve in major labor in most families and engage in heavy manual labor, sometimes. Therefore, it is shown that there are little changes in skinfold thickness of Pingliang males with aging and sometimes, the trend is downward, becoming thinner and thinner. Wuwei is the convergence zone of Qinghai-Tibet Plateau, the Loess Plateau and Inner Mongolia Plateau. And the elevation is between 2040-4874 m (Lanzhou City center of elevation is 1520 m). The territory of climate is cold plateau climate. In Wuwei, Han nationality has the similar diet as Tibetan residents. The is large intake of meat, dairy products, roasted barley flour, butter tea and highland barley wine in the diet of Wuwei residents. The reducing of skinfold thickness is accompanied with the rising elevation (Wang et al., 2001a) and the ambient temperature (Wang et al., 2001b). The skinfold thickness of Gansu Han female has similar trends with age. The reason is that the age of the female skinfold thickness trends was related to the female hormone secretion. In the adolescence, the female ovarian improved the abilities to secreting estrogen, and inhibited growth hormone, enhancing insulin action; it promoted the cytoplasmic volume, and then fat began to accumulate in large numbers. After menopause (about 45-50 years old), the abilities of the female hormone secretion are drastically reduced, the abilities of the accumulation of fat get diminished, and the fat layer becomes thin (Suo et al., 2005).

It can be seen that the proportion of Lanzhou male and female overweight and obesity rates were higher than in Pingliang and Wuwei males and females. The reasons are the favorable conditions of nutrition in Lanzhou and usual office-based work, in contrast with the large amount of farm-based physical labor. In addition, the overweight proportions of Lanzhou male are higher than that of women, and the overweight and obesity proportions of Pingliang and Wuwei females are higher than that of male. There are some reasons for increasing working pressure for females in Lanzhou.

RECOMMENDATION

The investigation found that the proportion of overweight and obesity of Lanzhou is better than that of Pingliang and Wuwei. It prompted that the risk of the Lanzhou adults suffering from obesity-related diseases is higher than Pingliang and Wuwei, where male is more obvious than female. The recommendation is that the Lanzhou adults of Han Nationality should prevent obesity-related diseases by proceeding to adjust diet and doing exercises. This same suggestion is meant to give a cue to Wuwei adults in 40-age group, Lanzhou adults in 50-age group and Pingliang female 50-age group.

ACKNOWLEDGEMENT

The authors are thankful to National Natural Science Funds (30830062).

REFERENCES

Brozek J (1963). Densitometric analysis of body composition:Revision of some quantitative assumptions. Ann. New York Aead. Sci. 104:110-113.

Chen M (1993). Anthropometric Science.Beijing: Peking University Health Science Center Press and Peking Union Medical College Press.

Davies PSW (1994). Body composition assessment. Arch. Dis. Child 69:337-338.

Esco MR, Olson MS, Williford HN, Russell AR, Gaston K (2011a). Skinfold Thickness is Related to Cardiovascular Autonomic Control as Assessed By Resting Heart Rate Variability. J. Strength Cond. Res. doi: 10.1097/01.JSC.0000395741.73051.cf.

Esco MR, Williford HN, Olson MS (2011b). Skinfold Thickness is

Related to Cardiovascular Autonomic Control as Assessed by Heart Rate Variability and Heart Rate Recovery. J. Strength Cond. Res. 25(8):2304-2310.
Garrow JS (1983). Indices ofadiposity. Nutr. Abstr. Rev. 53:697-708.
Huang W, Yang W, Lin D (2007). Obesity evaluation in 7-18 years old Dalian students from 1995 to 2005: Calculating the body fat content with skinfold thickness. J. Clin. Rehabil. Tissue Eng. Res. 2(36):7271-7274.
Knechtle B, Knechtle P, Rosemann T (2011). Upper Body Skinfold Thickness is related to Race Performance in Male Ironman Triathletes. Int. J. Sports Med. 32(1):20-27.
Liu X, Zhang G, Ma E (2009). A study on skinfold thickness measurement and body composition analysis of students in the Huining senior middle school. Anthropologica Sinica 28(2):172-177.
Lukaski HC (1987). Methods for the assessment of human body composition: traditional and new. Am. J. Cm. Nutr. 46:537-56.
Suo L, Lu S, Zhang l (2005). Skinfold thickness and its variations in RUSS nationality adults [J].Natl. Sci. J. Harbin Norm. Univ. 21(3):103-108.
Wang W, Zhang X, Chen Z (2001a). Survey on thickness of rhicnosis and quantity of body-fat in youths living at different height of altitude for one year. J. High Altitude Med. 20(3):311.
Wang Z, Xu Q, Liu L (2001b). The effect ofhot and cold environment on skinfold thickness. Chin. J. Sports Med. 20(3):311.
Wang Z, Zheng L, Zhang X (2011). Study on skinfold thickness of Shandong Han nationality adults[J]. J. Tianjin Norm. Univ. Nat. Sci. Edit. 31(1):80-85.
Xi H, Chen z (2010). Anthropometric Methods. Beijing: Science Press 10.
Xiao Y, Xi H (2009). Study on the measurement of skinfold thickness and estimation of body composition in Tibetan students aged 7-18 in Tibet. Mod. Prevent. Med. 36(7):1236-1238.
Xu F, Ma X, Zhao W (2000). A Study on development in subcutaneous fat among Dalian students of Han nationality. Chinese J. Sch. Health 21(2):84-85.
Zheng L, Li S, Lu S (2004). Variations of skinfold thickness in Uzbek adults. Chinese J. Anat. 27(4):438-440.
Zheng L, Zhu Q, Wang S (2003). Skinfold thickness and its variations in DAUR adults. Anthropologica Sinica 22(1):45-50.