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Study on body composition and its correlation with obesity

A Cohort Study in 5121 Chinese Han participants

Xiongfei Liang, MD[a,b], Xianhua Chen, MD[b], Jing Li, MS[c], Mengdan Yan, MS[c], Yifeng Yang, MD[a,*]

Abstract

Rare reports can be found about sex- and age-specific body composition survey among Chinese population. The aim of this study is to explore the change of body composition with aging in Chinese males and females respectively.

The present cross-sectional study was carried out in Central South University Xiangya School of Medicine Affiliate Haikou Hospital, on a random sample consisting of 5121 participants. Inbody720 body composition analyzer was used to detect the human body composition. Data collection was based on the assessment of anthropometric body composition measurements done with the help of bioelectric impedance. And the data were analyzed with SPSS19.0.

We selected 5121 participants, 3276 males and 1845 females. A significant trend ($P < 0.05$) for all anthropometric indices was observed with age for both genders. Body fat in men and women were 18.33 kg and 19.82 kg, respectively. Body fat percentage in men and women were 25.74% and 34.01%, respectively. Visceral fat area in men and women were 91.98 cm^2 and 77 cm^2, respectively And, with the increase of age, body fat, body fat percentages and visceral fat area also increased, both in men and in women. Meanwhile, with the increase of BMI, the body fat, body fat percentages, and visceral fat area also increased, both in men and in women.

Significant trends were observed for body fat, body fat percentages and visceral fat area for both genders with age and both genders with BMI. Focusing on obesity-related lifestyle and prevent weight gain.

Abbreviations: BFP = body fat percentage, BIA = bioelectrical impedance analysis, BMI = body mass index, VFA = visceral fat area, WC = waist circumference, WHR = waist-hip ratio of fat.

Keywords: body composition, body mass index, Hainan population, inbody720 body composition analyzer, obesity

1. Introduction

At present, obesity is well recognized as one of the major public health issues worldwide. Prior to the 1980s, the prevalence of obesity has been very stable, but has since increased dramatically throughout the world.[1] According to the 2014 World Health Organization (WHO), a rough estimate of 600 million obese adults worldwide. A Chinese nutrition survey shows that the prevalence of overweight and obesity was 19.2% and 15.0%, respectively.[2] Obesity is a serious problem because of the increasing possibility of a wide range of health consequences, including hypertension, insulin insensitivity, diabetes mellitus, cardiovascular disease, and distinct types of cancers.[3] The cost of medical care for obese patients is 30% higher than that of the normal weight peers.[4]

Human body composition is one of the branches of human biology, mainly to study the change rule of the number of body composition in human body, the influence of various factors in vivo and in vitro on the quantitative relationship between components, as well as in vivo determination of human components.[5] Body composition measurements not only indicate systemic nutritional status and health status, but also provide valuable information for the diagnosis and treatment of various diseases, whose quality and distribution are closely related to the health status of people at all ages.[6] The human body consists of 4 components: fat, protein, water and inorganic salts, the proportion of its composition is an important measure of physical health standards, the proportion of dysplasia is the root cause of the development of many diseases, to maintain the proportion of body composition is normal to achieve body composition balance, and maintain the health status of a basic condition,[7,8] at the same time, its composition to a certain extent, also reflects the gender, age, geographical, genetic, growth and development, nutrition, socioeconomic level, and disease and other factors.

Obesity in Saudi Arabia is a major public health concern, which is one of the fastest growing countries in the world. Azzeh and his colleague [9] found that along with the increase of age, body mass index, waist circumference, body fat, visceral fat and

Editor: Giovanni Tarantino.

This work is supported by Hainan Natural Science Foundation Project (No. 20168318).

The authors have no conflicts of interest to disclose.

[a] Department of Cardiothoracic Surgery, the Second Xiangya Hospital of Central South University, Changsha, [b] Central South University Xiangya School of Medicine Affiliate Haikou Hospital, Haikou, Hainan, [c] Key Laboratory of Resource Biology and Biotechnology in Western China (Northwest University), Ministry of Education, Northwest University, Xi'an, Shaanxi, China.

[*] Correspondence: Yifeng Yang, #139 Renmin Middle Road, Furong District, Changsha 410011, Hunan, China (e-mail: yyf627@163.com).

Medicine (2018) 97:21(e10722)

Received: 10 November 2017 / Accepted: 23 April 2018

http://dx.doi.org/10.1097/MD.0000000000010722

muscle mass also increase, whether in men or women. Mott et al[10] reported that at the age of <70 years old, with the increase of age, the amount of body fat mass also increased in 4 ethnic groups (Asian, Black, Puerto Rican, White); when the age was >70, the body fat mass decreased slightly. In the Xinjiang region of China, Liu et al[11] analysis the body composition characteristics in different nationalities in Urumqi overweight obesity and analysis the component change trend, the results shown that among overweight people, Han ethnicity males, and Uighur men had statistically significant differences in visceral fat are. In the obesity group, Uygur adults had a significantly difference in body fat percentage (BFP), waist-hip ratio of fat (WHR), and visceral fat area (VFA) than that in Han men and women. So, the body composition exist racial differences and regional differences.

Therefore, with the increase of age, systematic assessment of the changes in human body components is important for human health and nutritional status. Therefore, the main purpose of this study is to explore the relationship between human body composition and age and obesity in Hainan population.

2. Materials and methods

All subjects declared their written informed consent and were familiar with the aims, methods and risks of participating in the study in accordance with the Helsinki Declaration and rules of Good Clinical Practice, as the study was approved by the Ethics Committee of the Central South University Xiangya School of Medicine Affiliate Haikou Hospital. The ethics number for the study is 2015-039.

We recruited 5121 participants in physical examination center of Central South University Xiangya School of Medicine Affiliate Haikou Hospital from December 2015 to April 2017, which including 3276 males (aged 9–88 years) and 1845 females (aged 7–90 years). When participants have the following diseases or tumors, we will be excluded, such as cardiovascular diseases, metabolic diseases, chronic diseases, etc., pregnant women are also excluded.

Inbody720 body composition analyzer (Biospace Co., Korea) was used to detect the human body composition based on the recommendation provided in the user manual (according to the principle of bioelectrical impedance, the size of the different components in the body through current is different, have different electrical impedance). The subjects were tested in the quiet state after fasting emptying in the morning. When the test subjects barefoot standing on the pedal plate electrode, hands naturally hang down, hold the hand electrode gently, and the angle between the trunk and upper limbs is maintained at 15°, the subject is in a relaxed state, the test indexes including basal metabolic rate, lean body weight, intracellular fluid, extracellular fluid, protein content, mineral content, body water content, skeletal muscle, body fat, abdominal obesity, etc. Weight in kilograms with no shoes in a minimal clothing state by a digital scale (Beurer, Germany), height in centimeters was measured. BMI was calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2). According to the working group on obesity (WGOC) recommended BMI classification criteria: underweight (<18.5 kg/m^2), normal weight (18.5 to 24 kg/m^2), overweight (24 to 28 kg/m^2), and obesity (≥28 kg/m^2).

Descriptive anthropometry and body composition are presented as the means and standard deviation for men and women separately. Student's *t* test analysis was performed to investigate differences in mean values of anthropometric measures between men and women. According to the age criteria of WHO, young people are subdivided into those under 30 and 30 to 45, so, the subjects were divided into one of the following 4 age groups: <30 years old, 30 to 45, 45 to 60, > 60 years old. Use l<30 years old as a reference, to analysis the trends of baseline characteristics of both genders with age brackets in male and female. According to the working group on obesity (WGOC) recommended BMI classification criteria: underweight (<18.5 kg/m^2), normal weight (18.5 to 24 kg/m^2), overweight (24 to 28 kg/m^2), and obesity (≥28 kg/m^2). Use normal weight (18.5 to 24 kg/m^2) as a reference, we used variance analysis to analysis the relationship between the body composition and BMI in male and female. Data analysis was performed using the Statistical Package for Social Sciences (SPSS) software version 19. A P-value < .05 was considered statistically significant.

3. Results

3.1. Baseline characteristics of study sample stratified by gender

From Table 1, the mean of BMI was calculated in males and females, 24.48±3.37 for males and 23.18±3.33 for females. The basal metabolic rate of males and females were 1480 ± 142.88

Table 1

Baseline characteristics of study sample stratified by gender.

	Male		Female	
	Number	Mean ± SD	Number	Mean ± SD
Height, cm	3276	168.65 ± 6.3	1845	157.38 ± 6.17
Age, years	3274	43.8 ± 15.53	1845	45.55 ± 14.7
Weight, kg	3276	69.72 ± 10.83	1845	57.41 ± 8.86
Body mass index, kg/m^2	3276	24.48 ± 3.37	1845	23.18 ± 3.33
Basal metabolic rate, kcal/d	3276	1480 ± 142.88	1845	1181.92 ± 109.65
Lean body weight, kg	3276	51.39 ± 6.62	1845	37.59 ± 5.08
Intracellular fluid, kg	3276	23.54 ± 3.32	1845	16.92 ± 2.34
Extracellular fluid, kg	3276	14.25 ± 1.99	1845	10.64 ± 1.6
Protein, kg	3276	10.17 ± 1.43	1845	7.32 ± 1.01
mineral content, kg	3276	3.43 ± 2.39	1845	2.74 ± 2.2
Body water content, kg	3276	37.78 ± 5.24	1845	27.56 ± 3.72
Skeletal muscle, kg	3275	28.67 ± 4.01	1843	20.09 ± 3
Body fat, kg	3276	18.33 ± 6.49	1845	19.82 ± 5.97
Body fat percentage, %	3276	25.74 ± 6.42	1845	34.01 ± 6.51
Visceral fat area, cm^2	3276	91.98 ± 34.95	1845	77 ± 33.77

Table 2

Trends of baseline characteristics of both genders with age brackets.

	Male				Female			
	<30 (880)	30≤X<45 (790)	45≤X<60 (1058)	≥60 (539)	<30 (400)	30≤X<45 (419)	45≤X<60 (709)	≥60 (305)
BMI, kg/m^2								
Mean±SD	23.11±3.58	24.88±3.29	25.4±3.03	24.35±3.05	20.85±2.95	22.65±2.84	24.31±3.01	24.31±3.43
P-value		0.171	<0.05	0.003		0.525	0.399	0.003
Basal metabolic rate, kcal/d								
Mean±SD	1500.03±147.65	1505.47±136.93	1486.31±130.05	1392.1±127.39	1157.2±120.41	1192.24±104.75	1197.81±96.75	1149.79±90.8
P-value		.016	<.05	<.05		.35	.037	.059
Lean body weight, kg								
Mean±SD	52.32±6.84	52.57±6.34	51.68±6.02	47.32±5.9	36.45±5.57	38.07±4.85	38.32±4.48	36.1±4.2
P-value		.016	<.05	<.05		.355	.038	.06
Intracellular fluid, kg								
Mean±SD	24.06±3.16	24.16±2.91	23.63±2.76	21.41±2.72	16.5±2.59	17.19±2.35	17.31±2.04	16.21±1.92
P-value		.014	<.05	<.05		.492	.021	.04
Extracellular fluid, kg								
Mean±SD	14.32±1.84	14.4±1.73	14.39±1.69	13.48±1.66	10.21±1.5	10.66±1.39	10.85±1.28	10.37±1.19
P-value		.027	.005	.009		.543	.227	.235
Protein, kg								
Mean±SD	10.4±1.37	10.44±1.26	10.21±1.19	9.26±1.18	7.13±1.12	7.43±1.02	7.48±0.88	7.01±0.83
P-value		.014	<.05	<.05		.49	.021	.035
Mineral content, kg								
Mean±SD	3.54±0.5	3.56±0.93	3.45±0.42	3.17±0.44	2.6±0.39	2.79±2.16	2.68±0.32	2.52±0.29
P-value		.771	<.05	<.05		.352	.024	.024
Body water content, kg								
Mean±SD	38.38±4.98	38.56±4.6	38.02±4.42	34.89±4.33	26.71±4.07	27.85±3.73	28.16±3.3	26.57±3.1
P-value		.015	<.05	<.05		.5	.051	.075
Skeletal muscle, kg								
Mean±SD	49.41±6.43	49.63±5.93	48.85±5.68	44.71±5.57	34.28±5.26	35.74±4.79	36.11±4.23	34.01±3.98
P-value		.015	<.05	<.05		.478	.041	.063
Body fat, kg								
Mean±SD	15.56±6.82	18.57±6.18	20.1±5.81	19.32±5.86	16.49±5.35	19.08±5.33	21.66±5.33	21.48±6.17
P-value		.055	<.05	.012		.653	.893	.023
Body fat percentage, %								
Mean±SD	22.17±6.42	25.58±5.68	27.60±5.33	28.51±6.14	30.65±6.08	32.99±5.83	35.76±5.31	36.72±6.18
P-value		<.05	<.05	.034		.074	<.05	.882

BMI = body mass index.

P < .05 indicates statistical significance.

kcal and 1181.92±109.65 kcal, respectively. Body fat in men and women were 18.33±6.49 and 19.82±5.97. The body fat percentage in men and women were 25.74% and 34.01%. Visceral fat area in men and women were 91.98±34.95 cm^2 and 77±33.77 cm^2, respectively.

3.2. Trends of baseline characteristics of both genders with age brackets

According to WHO's age criteria, the subjects were divided into one of the following 4 age groups: <30 years old, 30 to 45, 45 to 60, >60 years old. Use <30 years old as a reference, to analysis the trends of baseline characteristics of both genders with age brackets in male and female. From Table 2, with age, the body composition will follow the change.

According to the age group, under 30 years, 30 to 45 years old, 45 to 60 and 60 years, in men, the mean value of BMI were 23.11±3.58, 24.88±3.29, 25.4±3.03, and 24.35±3.05 kg/m^2. In women, the mean value of BMI were 20.85±2.95, 22.65±2.84, 24.31±3.01, 24.31±3.43 kg/m^2; In men, the mean value of body fat were 15.56±6.82, 18.57±6.18, 20.1±5.81, and 19.32±5.86; while in women, the mean value of body fat were 16.49±5.35, 19.08±5.33, 21.66±5.33, 21.48±6.17 kg. In men, the mean value of body fat percentage were 21.17%, 25.58%, 27.60%, and 28.51%; In women, the mean value of body fat percentage were 30.65%, 32.99%, 35.76%, and 36.72%.

According to the age group, under 30 years, 30 to 45 years old, 45 to 60 and 60 years, in men, the mean of protein were 10.4, 10.44, 10.21 and 9.26 kg; the mean of intracellular fluid were 24.06, 24.16, 23.63, and 21.41 kg; the mean of extracellular fluid were 14.32, 14.4, 14.39, and 13.48 kg. While in women, the mean of protein were 7.13, 7.43, 7.48, and 7.01 kg; the mean of intracellular fluid were 16.5, 17.19, 17.31, and 16.21 kg; the mean of extracellular fluid were 10.21, 10.66, 10.85, and 10.37 kg.

3.3. Correlation between body composition and BMI

According to BMI stratification, the differences of different components and indexes in different sex groups were analyzed. Table 3 shows the analysis of variance ANOVA for the correlated variables and BMI. It is clear from Table 3 that with the increase of BMI, the mean of protein content, body fat and basal metabolic rate also increased, both in men and in women.

According to BMI stratification (BMI < 18.5, 18.5≤BMI < 24, 24≤BMI < 28, and BMI≥28), for body fat, in men, 7.69±2.31, 13.87±3.62, 20.62±3.43, and 28.15±5.11 kg, respectively; in women group, in order, 10.97±2.08, 17.55±3.35, 23.7±3.25,

Table 3

Correlation between body composition and BMI.

	Male				Female			
	BMI group	N	Mean ± SD	*P*	BMI group	N	Mean ± SD	*P*
Protein, kg	18.5≤b<24	1374	9.62 ± 1.09		18.5≤b<24	1042	7.13 ± 0.81	
	<18.5	111	8.51 ± 1.21	.287	<18.5	127	6.34 ± 0.63	.007
	24≤b<28	1335	10.47 ± 1.14	.007	24≤b<28	518	7.7 ± 0.97	.002
	≥28	447	11.3 ± 1.33	<.05	≥28	146	8.11 ± 1.21	<.05
Intracellular fluid, kg	18.5≤b<24	1374	22.26 ± 2.51		18.5≤b<24	1042	16.5 ± 1.89	
	<18.5	111	19.69 ± 2.79	.283	<18.5	127	14.68 ± 1.46	.006
	24≤b<28	1335	24.22 ± 2.63	.008	24≤b<28	518	17.81 ± 2.24	.002
	≥28	447	26.15 ± 3.08	<.05	≥28	146	18.77 ± 2.79	<.05
Extracellular fluid, kg	18.5≤b<24	1374	13.49 ± 1.42		18.5≤b<24	1042	10.33 ± 1.15	
	<18.5	111	12.11 ± 1.59	.333	<18.5	127	9.27 ± 0.94	.015
	24≤b<28	1335	14.62 ± 1.54	.001	24≤b<28	518	11.1 ± 1.34	.004
	≥28	447	15.81 ± 1.78	<.05	≥28	146	11.75 ± 1.61	<0.05
Mineral content, kg	18.5≤b<24	1374	3.27 ± 0.52		18.5≤b<24	1042	2.63 ± 1.38	
	<18.5	111	2.86 ± 0.41	.02	<18.5	127	2.33 ± 0.23	.594
	24≤b<28	1335	3.57 ± 0.66	.027	24≤b<28	518	2.75 ± 0.35	.874
	≥28	447	3.84 ± 0.49	<.05	≥28	146	2.86 ± 0.44	.75
Body water content, kg	18.5≤b<24	1374	35.75 ± 3.89		18.5≤b<24	1042	26.82 ± 3.01	
	<18.5	111	31.8 ± 4.36	.289	<18.5	127	23.95 ± 2.38	.007
	24≤b<28	1335	38.84 ± 4.11	.002	24≤b<28	518	28.91 ± 3.56	.002
	≥28	447	41.96 ± 4.81	<.05	≥28	146	30.52 ± 4.38	<.05
Lean body weight, kg	18.5≤b<24	1374	48.65 ± 5.36		18.5≤b<24	1042	36.58 ± 4.01	
	<18.5	111	43.17 ± 5.96	.319	<18.5	127	32.62 ± 3.23	.004
	24≤b<28	1335	52.88 ± 5.64	.003	24≤b<28	518	39.37 ± 4.85	.001
	≥28	447	57.1 ± 6.61	<.05	≥28	146	41.49 ± 6.01	<.05
Skeletal muscle, kg	18.5≤b<24	1374	27.03 ± 3.27		18.5≤b<24	1041	19.53 ± 2.39	
	<18.5	111	23.68 ± 3.64	.282	<18.5	127	17.14 ± 1.9	.005
	24≤b<28	1335	29.58 ± 3.42	.007	24≤b<28	518	21.23 ± 2.92	.001
	≥28	447	32.1 ± 4.01	<.05	≥28	146	22.48 ± 3.64	<.05
Body fat, kg	18.5≤b<24	1374	13.87 ± 3.62		18.5≤b<24	1042	17.55 ± 3.35	
	<18.5	111	7.69 ± 2.31	<.05	<18.5	127	10.97 ± 2.08	<.05
	24≤b<28	1335	20.62 ± 3.43	.083	24≤b<28	518	23.7 ± 3.25	.438
	≥28	447	28.15 ± 5.11	<.05	≥28	146	31.15 ± 4.79	<.05
Body fat percentage, %	18.5≤b<24	1374	22.11 ± 5.07		18.5≤b<24	1042	32.33 ± 4.88	
	<18.5	111	15.16 ± 4.58	.146	<18.5	127	25.12 ± 4.12	.322
	24≤b<28	1335	28.09 ± 4.25	<.05	24≤b<28	518	37.63 ± 4.22	.001
	≥28	447	32.97 ± 4.23	<.05	≥28	146	42.89 ± 4.07	.027
Basal metabolic rate, kcal/d	18.5≤b<24	1374	1420.77 ± 115.88		18.5≤b<24	1042	1160.17 ± 86.53	
	<18.5	111	1302.46 ± 128.57	.328	<18.5	127	1074.61 ± 69.79	.005
	24≤b<28	1335	1512.22 ± 121.76	.003	24≤b<28	518	1220.33 ± 104.8	.001
	≥28	447	1603.34 ± 142.83	<.05	≥28	146	1266.23 ± 129.83	<.05

BMI = body mass index.

P < .05 indicates statistical significance.

and 31.15 ± 4.79 kg. For body fat percentage, in men, 22.11%, 15.16%, 28.09%, and 32.97%, respectively; in women, in order, 32.33%, 25.12%, 37.63%, and 42.89%.

4. Discussion

In 2014, WHO declared that the worldwide prevalence of overweight and obesity affected about 1.9 billion adults aged 18 years or elder. This study is the first directly comparative study of body composition and obesity-related in Hainan population. Our results showed that with the increase of age, body fat, body fat percentages and visceral fat area also increased, both in men and in women. Meanwhile, with the increase of BMI, the body fat, body fat percentages and visceral fat area also increased, both in men and in women. Significant trends were observed for body fat, body fat percentages, and visceral fat area for both genders with age and both genders with BMI.

In our study, body fat in men and women were 18.33 and 19.82. The body fat percentage in men and women were 25.74% and 34.01%. Visceral fat area in men and women were 91.98 and 77 cm^2. And, with the increase of age, body fat, body fat percentages and visceral fat area also increased, both in men and in women. Meanwhile, with the increase of BMI, the body fat, body fat percentages and visceral fat area also increased, both in men and in women. Studies by Yusuf et al[12] showed that after middle age, body fat accumulation began to increase with age and tended to accumulate in certain areas of the body. In general, the fat accumulation of males is "Apple type," and their fat mainly accumulates in the abdomen of the trunk. The fat accumulation of females is "pear type," and their fat mainly accumulates below the waist to the thigh part. The "Apple type" is more dangerous than "pear type" in the heart disease. Using InBody 720 body composition analyzer to measure 1121 obese adults overweight body mass index, body fat percentage, waist-hip ratio of fat and

visceral fat area, and compare the body composition changes in different groups. The results suggested that Han ethnicity males and Uighur men had significantly difference in BFP, WHR, and VFA than that in Han men and women.[11] Heo et al[13] analysis the trend of percentage of body fat in 3 race-ethnicity groups (non-Hispanic whites, non-Hispanic blacks, and Mexican Americans), and the results shown that as the body mass index increases, the percentage of body fat also increases no matter in male group and female group. One research in Kuwait people revealed that the body fat percentages of males and females are 23.3% and 37.7%, respectively, females were greater than that for males, and males have a significantly higher proportion of obesity than women.[14] This result is consistent with the findings of other studies in other countries. Although the trend of body fat rate is similar in different countries, there are still some differences. Body fat percentages differ among countries depending on genetic factors, eating patterns, regular exercise, and other life-style habits. Studies revealed that obesity is associated with the occurrence of various diseases, such as insulin resistance, T2DM, stroke_, CVD, MetS, non alcoholic fatty liver disease. The accumulation of visceral fat also related to T2DM, CVD, insulin resistance.[15] Some research found that weight gain in adulthood appears to increase the risk for colon cancer.[16] Valdes et al[17] pointed that obesity is not only related to shortened life expectancy, but also related to accelerated aging. So, focusing on obesity-related lifestyle and prevent weight gain is very important.

Extracellular fluid refers to exist in the extracellular fluids, including plasma, tissue fluid and lymph, is the internal environment of the body; Intracellular fluid is a kind of body fluids, which can directly affect cell metabolism and physiological function. Determination of the internal and external fluid amount to the cells of our bodies can not only reflect the status of the function of the body's tissues, can also display cell physiology. In our research, we found that under 30 years, 30 to 45 years old, 45 to 60 and 60 years, in men, mean of intracellular fluid were 24.06, 24.16, 23.63, and 21.41 kg; the mean of extracellular fluid were 14.32, 14.4, 14.39, and 13.48 kg. While in women, the mean of intracellular fluid were 16.5, 17.19, 17.31, and 16.21 kg; the mean of extracellular fluid were 10.21, 10.66, 10.85, and 10.37 kg. The research shows that after the age of 45, intracellular fluid has a tendency to decline, and the extracellular fluid has a tendency to rise. One research revealed that the middle-aged male group had the highest intracellular fluid and extracellular fluid volume, and the middle-aged group had significant differences with the young group and the elderly group. The middle-aged women also showed the highest level of intracellular and extracellular fluid, but there was no significant difference in the intracellular fluid between the young and middle-aged women. The mean intracellular fluid was the lowest in the elderly group, which was significantly different from the middle-aged group. The physiological state of the elderly cells are greatly reduced, while large differences between individuals.[18] At the same time, in our study found that as the growth of the age, with lower protein content. The study found that the volume change of extracellular fluid and intracellular fluid can reflect the conditions of nutrition metabolism of the body, poor nutrition can lead to the abnormal distribution of extracellular and intracellular fluid, shown that extracellular fluid increases, intracellular fluid decreases, and more serious the degree of malnutrition.[19] And to a certain extent, the decrease of intracellular fluid is associated with an increased protein catabolism. For obese people, with the increase of body fat, extracellular fluid volume also increased.[20] Several other studies have examined extracellular water volume in relation to BMI. Brochner-Mortensen et al[21] matched obese and nonobese patients for height and age and found higher extracellular water volume in the obese, while Visser et al[22] recorded a positive correlation between BMI and the increase in extracellular water volume.

Bioelectrical impedance analysis (BIA) was first proposed by Lukaski,[23] and it assumes that the body is composed of fat and nonfatty substances, to use the conductive differences of human body fat, water and other components of the body to determine the content of body composition. The study shows that bioelectrical impedance method is one of the important methods of body composition measurement, which can reflect the weight and distribution of body fat and can be evaluated nutritionally, has the advantages of simple operation, fast detection, safe, noninvasive, economy, reliability, and validity, etc., suitable for large-scale research group, has an important value in the diagnosis obesity or malnutrition.[24–26]

There are several potential limitations of the present study: Firstly, we used the Inbody 720 body composition analyzer, which originally developed and validated only in the Korean population. There are genetic differences in the Korean and the Chinese population; there may be significant differences in body fat composition. This may create a systematic bias in the analysis. Secondly, in order to get more accurate and reliable results, the sample size is still not big enough, and the sample size needs to be adjusted according to the occurrence probability of Type 1 and Type II errors. Thirdly, this study inevitably has a certain bias in the selection of the respondents. In order to strengthen the strength of its argument and verify its conclusion, large-scale, multi-category research is still needed.

5. Conclusions

In our research, we found that significant trends were observed for body fat, body fat percentages and visceral fat area for both genders with age and both genders with BMI. Focusing on obesity-related lifestyle and prevent weight gain. In recent years, studies have showed that the body composition anomalies is closely related to lipid metabolic disorder diseases, such as obesity, diabetes and other disease, these may be a risk factor for cardiovascular disease. According to the results of body composition analysis, can be found the body composition change and adipose accumulation as early as possible, in order to change lifestyle of each age overweight and obese people, improve the subhealth.

Acknowledgments

We are grateful to individuals who participated in the study. We would also like to thank the clinicians and other hospital staff who contributed to the data collection for this study.

Author contributions

Conceptualization: Yi feng Yang.
Data curation: Xian hua Chen, Jing Li, Meng dan Yan.
Formal analysis: Xiong fei Liang, Xian hua Chen, Jing Li, Meng dan Yan.
Funding acquisition: Yi feng Yang.
Methodology: Jing Li, Meng dan Yan.
Project administration: Yi feng Yang.
Software: Xian hua Chen.
Writing – original draft: Xiong fei Liang.
Writing – review & editing: Yi feng Yang.

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