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HEALTH EVALUATION OF COMBINED PHYSICAL EXERCISE, TAEKWONDO-AEROBIC TRAINING AND IMPROVED FOOD

[1]Soo Jung Kim PhD, [2]Man Kyu Huh PhD
[1]Department of Taekwondo, Dong-Eui University, Busan 47340, Korea
[2]Food Science and Technology Major, Dong-Eui University, Busan 47340, Korea
Corresponding Author Email: mkhuh@deu.ac.kr

ABSTRACT

Body water, proteins, minerals, and body fat, which are the components of the human body closely relate to the status of our health. This study is to investigate the effects of the physical activity, Taekwondo-aerobic training, and improved food levels of adolescents on their body compositions. Participants' divergent results for % fat change may be attributable to the marked fat loss coupled with changes in lean mass from the exercise and food control. Mineral mass was closely related to protein and soft lean mass. Protein and minerals increased in the 20s woman, the 30s man, and 50s man. Most participants have improved their visceral fat indices. The measuring equipment in the gym can help human to diagnose your health first. As these equations are formulated on population-specific data, they may contribute to error in body composition measurements in different populations.

Keywords: Body water, physical activity, Taekwondo-aerobic training

Introduction

Physical activity and exercise are often used interchangeably, but these terms are not synonymous. Physical activity is defined as any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements over resting energy expenditure (The President's Council on Physical Fitness and Sports, 2000). Exercise is a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve and/or maintain one or more components of physical fitness (Pescatello et al., 2014).

Body composition and growth are key components of health in both individuals and populations (Reilly et al., 2003). The ongoing epidemic of obesity in children and adults has highlighted the importance of body fat for short term and long term health (Wells and Fewtrell, 2006).

Body water, proteins, minerals, and body fat, which are the components of the human body closely relate to the status of our health. Body composition analysis is essential to completely understand health and weight as traditional methods of assessing health. Using the method of quantitative analysis, these elements of body composition and body composition analysis provide basic information required for assessing the status of the body. The late 1960s, the bioelectrical impedance analysis (BIA) method measures body water by obtaining the impedance index. The impedance index is obtained by applying a small alternating current on the body, based on the principle that the body contains water and that the level of electric resistivity, i.e., resistance, changes according to the amount of water in the body.

In the late 1980s, the BIA method was a single-frequency whole-body impedance measurement that yielded inaccurate results, and required the use of statistical variables for correction of measurements (NIH, 1994). However, the empirical data used in the formula were highly specific and could not be applied universally, and in turn affected overall precision.

Motivated through understanding the cause of BIA's inaccuracy as a limitation in technology, the solution for the limitation could be solved through technological innovation. In 1996, Dr. Cha developed the InBody, "world's first commercial BIA body composition analyzer, capable of both direct measurement of body segments and multifrequency measurements.

Body composition measurement methods are continuously being perfected with the most commonly used methods being bioelectrical impedance analysis (Lee and Gallagher, 2008). Recent developments include three-dimensional photonic scanning and quantitative magnetic resonance. Collectively, these techniques allow for the measurement of fat, fat-free mass, bone mineral content, total body water, extracellular water, total adipose tissue and its subdepots (visceral, subcutaneous, and intermuscular), skeletal muscle, select organs, and ectopic fat depots. InBody measures body composition and displays it on an organized. It gives a detailed analysis of where fat and muscle are, where body water levels are at, and is a guide to help achieve goals: whether that is shedding a few unwanted pounds or a complete body transformation.

Today, the advancement to BIA technology brought out by the InBody with exceptional precision and convenience of use widely recognized by experts worldwide. The InBody is mentioned in hundreds of research papers published every year across various fields such as nutrition, sports, and obesity.

The purpose of this study is to investigate the effects of the physical activity, Taekwondo-aerobic training, and improved food levels of adolescents on their body compositions.

Materials and Methods

Exercise Training Program

Participants undertook combined physical exercise, Taekwondo-aerobic training, and improved food. The physical exercises included the chest press, seated row, shoulder press, triceps extension, leg press, leg extension and leg curl, with abdominal crunches also performed [6]. Sessions commenced and concluded with general flexibility exercises. The aerobic component of the training program conducted 30 minutes twice a week for one year.

Direct segmental multi-frequency bioelectrical impedance analysis (DSM-BIA)
DSM-BIA was performed using the In-Body (720) body composition analyzer. This equipment has previously been shown to have high test-pretest reliability and accuracy (Gibson et al., 2008; Galva˜o et al., 2010).

Random Assignment

Control participants could undergo the training after the assessment period had been completed. After completion of the baseline assessment, participants were randomly selected using a computer random assignment program. One man and one woman in their 20s, 30s, 40s, and 50s were randomly selected.

Statistical Analyses

The measurements were prepared in triplicate for each analysis. Data were analyzed using the SPSS version 21 (SPSS Inc, Chicago, IL) statistical software package. To determine if

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general health changes were mediated by changes in lean mass and functioning, correlations were explored between self-reported general health and objective measures of lean mass and muscle strength (Utter and Lambeth, 2010).

Ethical approval

The Institutional Sports of the Dong-eui University in the Korea approved the study. All men and women were consented by approved methods before participation.

Results

Characteristics of muscle-fat analysis are reported in Table 1. Difference between total weight measurements was not correlated with skeletal muscle mass (SMM). Thus, the divergent results for % fat change may be attributable to the marked fat loss coupled with changes in lean mass from the exercise. However, difference between total weight change measurements was associated with fat loss (Percentage of Body Fat, PBF). The 21-year-old man and 36-year-old woman lost a lot of weight and body fat. They performed exercise, Taekwondo-aerobic, and food control very well (Fig. 1). The rest of the participants were sometimes absent from the exercise session or were eating irregular meals. The 51 year-old man is deemed to be decreasing-weight due to the increased weight of their skeletal muscle.
Table 2 shows body composition analysis and change over one year exercise training. While body fat mass decreased from 20s to 50s except 20s woman, all other values did not shown significant differences. However, difference between % fat change measurements was related to fat loss. Weight alone does not correctly reflect the effects of exercise, Taekwondo-aerobic training, and improved diet. Mineral help the body preserve and play a care role in the human body. Mineral mass was closely related to protein and soft lean mass. Protein and minerals increased in the 20s woman, the 30s man, and 50s man. Women in their fifties have lost her protein and minerals.

Table 3 shows four men and four women whose obesity analysis and change, throughout a year of exercise, had minimal change; however, muscle mass and fat mass slightly increased and decreased respectively. Waist-Hip ratio (WHR) is determined by dividing the waist circumference from the navel line by the hip's maximum circumference. It is a useful indicator for comprehending the distribution of body fat. Visceral Fat Area is defined here as the cross-sectional area of visceral fat found in the abdomen. Three participants (20-year-old woman, the 30-year-old man, and 36-year-old female) had a WHR value in excess of the normal range. Most participants have improved their visceral fat indices. However, the 20-year-old woman and the 30-year-old man had worse indicators. Although they performed exercise and Taekwondo-aerobic, they have failed food control (Fig. 1).

DISCUSSION

Measuring body composition changes in severe obesity (20s female and 30s man) is challenged by the variability in fat-free mass hydration, body water distribution, and the composition of weight loss. Their weight control were failed. The major cause was the inability to control the diet. They did not eat a controlled diet after the exercise and ate more.
20-year-old woman and 30-year-old man who fall into this body type have an excessive amount of body weight and are diagnosed as being chronically obese. In these individuals, it is common to see the measured SMM over the average range (InBody, 2014). However, it is important to note that this is not developed through exercise: it is actually a result of the

individual having excessive body mass compared to the average weight, which triggered muscle development as a response to the need to carry the excess weight.

InBody analyzes two large groups of minerals: osseous and non-osseous minerals. Osseous minerals are the minerals found in the bones while non-osseous minerals are those which are found in all other parts of the body. Osseous minerals account for about 80% of the body's total minerals (InBody, 2014).

Obesity is generally defined as abnormal or excessive fat accumulation that presents health risks (WHO, 2011). Korean adolescents are at increased risk for obesity and associated health risks. Determining weight status through measurement of body fat percentage is important in diagnosing people obesity. People living in the city use a lot of gyms. The search for an accurate diagnostic instrument for measuring body fat that is practical and inexpensive is a challenge for common people.

In diagnosis and treatment of obesity, body composition analysis including percent body fat is useful in the clinical setting. Because bioelectrical impedance analysis (BIA) could be used quickly, easily and was non-invasive in clinical setting, the purpose of the present study was to evaluate the usefulness of multi-frequency BIA with eight-point tactile electrodes (MF-BIA8; InBody 720, Biospace) compared with dual-energy X-ray absorptiometry in healthy children and adolescents (Lim et al., 2009). The measuring equipment in the gym can help human to diagnose their health first. It is important to highlight that various BIA machines are supplied with proprietary prediction equations for the estimations of different body composition parameters. The details of these equations, as well as the raw measurement values generated by the BIA machine are generally unavailable to the users. As these equations are formulated on population-specific data, they may contribute to error in body composition measurements in different populations. Therefore, care needs to be taken in the selection of prediction equations to ensure that they are applicable to the characteristics of the subjects under study (Ling et al., 2011).

Table 1. Muscle-fat analysis and change over one year exercise training					
Gender (Age)	Measure	Baseline	6 month	One year	Normal
Male (21)	Total Weight, kg	71.0±1.04	67.4±1.07	64.5±1.56	56.6-76.6
	SMM, kg	31.4±1.43	32.7±1.04	32.1±0.35	28.5-34.8
	PBT, %	15.3±1.10	9.4±0.83	7.7±0.36	8.0-16.0
Female (20)	Weight	81.2±1.41	75.4±0.72	90.8±1.63	51.6-69.8
	SMM	26.3±0.65	25.8±1.34	29.1±2.47	23.2-28.4
	PBT	33.7±0.35	28.5±0.61	38.7±1.88	12.1-19.4
Male (30)	Weight	84.0±0.85	85.1±0.71	86.8±1.63	61.3-82.9
	SMM	39.6±1.65	40.6±1.64	39.9±2.05	31.0-37.8
	PBT	14.9±0.21	14.2±0.67	17.3±1.56	8.7-17.3
Female (36)	Weight	67.9±0.89	64.0±1.41	60.3±3.75	50.4-68.2
	SMM	24.1±0.71	24.2±0.53	24.8±2.26	22.6-27.6
	PBT	24.2±0.83	20.3±0.99	15.4±2.05	11.9-19.0
Male (40)	Weight	63.2±0.85	64.4±0.81	63.0±2.83	55.1-74.8
	SMM	29.7±0.65	30.6±0.49	29.8±0.92	27.8-34.0
	PBT	10.5±0.33	10.2±0.28	10.0±1.70	7.8-15.6
Female (41)	Weight	63.2±0.88	59.6±1.32	61.4±2.47	48.6-65.7
	SMM	25.9±0.62	25.1±1.34	26.1±0.91	21.7-26.6
	PBT	15.5±0.55	14.0±0.64	14.1±1.27	11.4-18.3
Male (51)	Weight	68.4±0.64	68.7±1.20	67.9±2.69	55.1-74.8
	SMM	28.1±0.95	29.3±0.46	29.4±3.54	27.8-34.0
	PBT	18.1±0.91	16.2±1.41	15.1±2.62	7.8-15.6
Female (57)	Weight	51.3±1.11	53.1±0.56	49.9±2.55	40.2-54.3
	SMM	20.8±1.12	20.5±0.95	19.6±2.12	17.1-21.6
	PBT	12.7±0.86	14.9±0.71	13.3±1.31	9.4-15.1

SMM: Skeletal Muscle Mass.
PBF: Percentage of Body Fat.
Results are from three experiments and are expressed as mean ± SD (n = 3).

Table 2. Body composition analysis and change over one year exercise training					
Gender (Age)	Measure	Baseline	6 month	One year	Normal
Male (21)	Total Body Water, kg	40.8±2.71	42.5±2.84	41.9±2.69	37.5-45.8
	Body Fat Mass	56.7±2.30	58.0±2.08	55.1±2.10	48.6-60.8
	Protein	11.1±1.33	11.6±1.06	11.2±2.00	10.0-12.3
	Mineral	3.77±0.79	3.94±0.74	3.72±1.22	3.46-4.23
Female (20)	Total Body Water	34.8±2.49	34.4±1.65	38.0±1.91	30.9-37.8
	Body Fat Mass	47.5±2.51	46.9±2.00	52.1±3.39	39.4-50.4
	Protein	9.3±0.75	9.1±1.15	10.3±1.33	8.3-10.1
	Mineral	3.40±0.40	3.41±1.10	3.77±0.54	2.86-3.50
Male (30)	Total Body Water	50.7±2.75	51.9±3.85	50.9±2.80	40.5-49.5
	Body Fat Mass	69.1±2.34	70.9±2.90	68.5±2.50	52.6-65.6
	Protein	11.1±0.85	14.2±1.51	13.9±1.31	10.-12.3
	Mineral	4.61±0.71	4.78±1.01	4.72±0.75	3.75-4.58
Female (36)	Total Body Water	32.0±3.01	32.1±3.85	32.9±2.07	32.2-36.9
	Body Fat Mass	43.7±2.15	43.7±2.90	42.9±2.06	38.5-49.2
	Protein	8.6±0.87	8.6±1.50	8.9±2.03	8.1-9.9
	Mineral	3.08±0.45	3.03±0.45	3.10±1.14	2.79-3.41
Male (40)	Total Body Water	38.8±3.06	39.8±2.385	39.0±2.49	36.6-44.7
	Body Fat Mass	52.7±2.52	54.2±3.20	53.0±2.30	47.5-59.2
	Protein	10.5±0.78	10.9±1.25	10.6±1.51	9.8-12.0
	Mineral	3.43±0.57	3.52±0.27	3.44±0.45	3.39-4.14
Female (41)	Total Body Water	34.3±2.66	33.4±3.26	34.7±3.42	29.1-35.6
	Body Fat Mass	46.8±3.71	45.5±4.25	47.3±3.22	37.2-47.4
	Protein	9.2±0.87	8.9±1.85	8.3±0.68	7.8-9.5
	Mineral	3.33±0.61	3.15±0.25	3.29±0.51	2.69-3.29
Male (51)	Total Body Water	37.0±2.25	38.6±2.60	38.6±3.14	36.6-44.7
	Body Fat Mass	50.3±2.50	52.5±3.05	52.8±3.20	47.5-59.2
	Protein	9.9±2.12	10.3±1.35	10.5±1.38	9.8-12.0
	Mineral	3.37±0.31	3.57±0.56	3.54±0.56	3.39-4.14
Female (57)	Total Body Water	28.3±2.70	28.0±3.51	26.8±1.05	24.1-29.4
	Body Fat Mass	38.6±3.05	38.2±3.46	36.6±3.60	30.7-39.2
	Protein	7.5±0.74	7.5±1.97	7.1±1.15	6.5-7.9
	Mineral	2.79±0.29	2.69±0.79	2.66±0.64	2.23-2.72

BMI: Basal Metabolic Rate.

Table 3. Obesity analysis and change over one year exercise training					
Gender (Age)	Measure	Baseline	6 month	One year	Normal
Male (21)	BMI	23.5±4.22	22.3±2.83	21.3±1.77	18.5-23.0
	PBF	21.6±5.99	14.0±4.24	11.9±2.76	10.0-20.0
	Waist-Hip Ratio	0.88±0.19	0.83±0.04	0.83±0.04	0.80-0.90
	Visceral Fat	6.0±1.41	3.0±0.58	2.0±0.71	10
Female (20)	BMI	28.1±1.97	26.1±2.69	31.4±2.83	18.5-23.0
	PBF	41.4±4.81	37.7±2.33	42.6±3.54	10.0-20.0
	Waist-Hip Ratio	1.02±0.32	0.98±0.06	1.03±0.11	0.80-0.90
	Visceral Fat	13.0±4.24	11.0±1.77	14.0±2.33	10
Male (30)	BMI	25.6±3.25	26.0±3.18	26.5±3.54	18.5-23.0
	PBF	17.7±2.62	16.7±1.84	20.0±0.85	10.0-20.0
	Waist-Hip Ratio	0.89±0.08	0.85±0.05	0.94±0.11	0.80-0.90
	Visceral Fat	6.0±0.71	6.0±0.71	7.0±0.71	10
Female (36)	BMI	24.1±2.47	22.7±3.03	21.4±1.13	18.5-23.0
	PBF	35.6±3.54	31.7±3.54	25.6±4.95	18.0-28.0
	Waist-Hip Ratio	1.0±0.28	0.94±0.09	0.89±0.09	0.75-0.86
	Visceral Fat	10.0±1.41	8.0±0.35	8.0±0.71	10
Male (40)	BMI	21.4±2.02	21.8±4.38	21.3±1.63	18.5-23.0
	PBF	16.5±2.83	15.9±3.18	15.8±2.47	10.0-20.0
	Waist-Hip Ratio	0.84±0.17	0.88±0.09	0.840.03	0.80-0.90
	Visceral Fat	6.0±0.73	4.0±0.74	3.0±0.02	10
Female (41)	BMI	22.9±2.62	21.9±4.10	22.6±2.05	18.5-23.0
	PBF	24.9±1.56	23.6±4.24	23.0±3.68	18.0-28.0
	Waist-Hip Ratio	0.98±0.15	0.86±0.08	0.85±0.10	0.75-0.86
	Visceral Fat	6.0±0.71	5.0±0.71	5.0±1.41	10
Male (51)	BMI	23.7±3.75	23.8±3.04	23.5±1.70	18.5-23.0
	PBF	26.5±1.91	23.5±4.45	22.3±2.12	10.0-20.0
	Waist-Hip Ratio	0.92±0.05	0.85±0.08	0.88±008	0.80-0.90
	Visceral Fat	7.0±1.41	6.0±0.01	6.0±1.41	10
Female (57)	BMI	22.8±3.89	23.8±4.53	22.2±0.28	18.5-23.0
	PBF	24.7±2.19	28.1±2.62	26.6±5.09	18.0-28.0
	Waist-Hip Ratio	0.83±0.06	0.83±0.04	0.83±0.08	0.75-0.86
	Visceral Fat	5.0±2.12	6.0±0.71	5.0±0.58	10

BMI: Basal Metabolic Rate (kg/㎡).

PBF: Percentage of Body Fat (%).

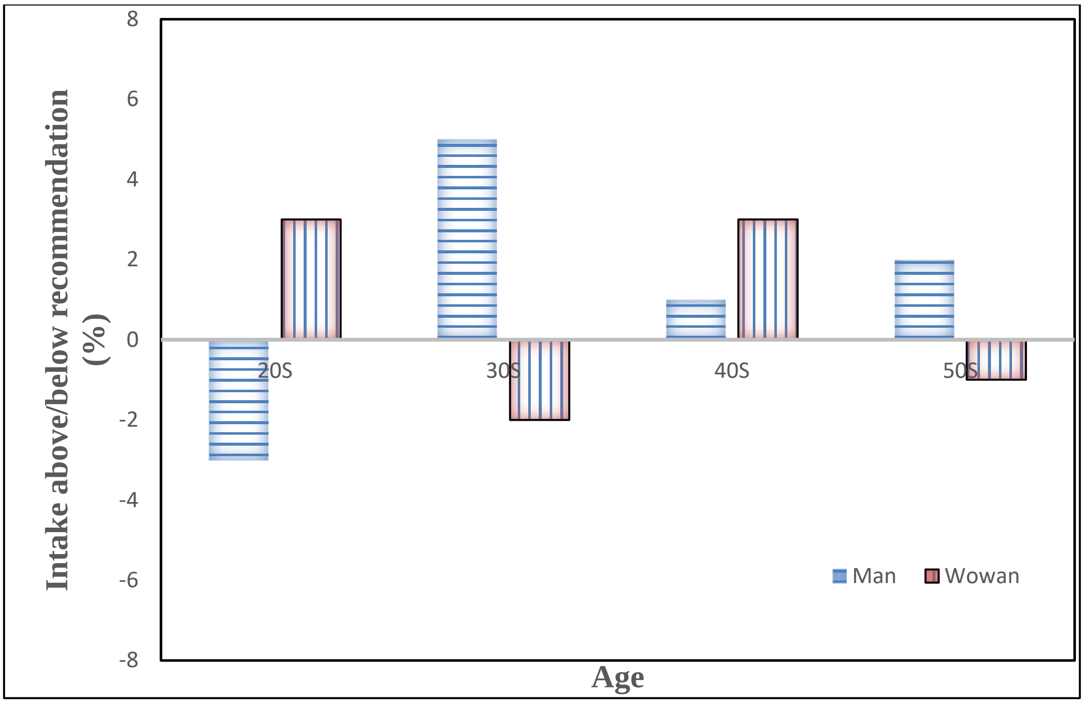

Fig. 1. Percentages (mean values) of intake food per one year above/below recommended dietary allowances according to ages.

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