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THE EFFECTS OF 8WEEKS KARATE TRAINING ON BODY COMPOSITION AND PHYSICAL PERFORMANCE IN ADULTS

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Abstract
This study examines the impact of 8 weeks of Karate training on the body composition and physical performance of adults in Karate training. The study adopted an experimental research design-a randomized controlled trial (RCT), where participants (N=20, 12 males, 8 females)comprised of two random groups – the control and experimental groups (n=10 per group, 6 males, 4 females). All the participants went through 10 minutes of warm-up activities and 10 minutes of relaxation exercises. The experiment group was specially subjected to a daily 40 minutes of karate exercise running consecutively for eight. After eight weeks, the participants under went several tests: vertical jump tests, handgrip strength tests, back-leg strengths test, and a series of flexibility tests.Researchers further tested participants' body composition, anaerobic capacity, and physical wellness using multiple tests: sprint tests heart rate tests, anaerobic power tests, amongst other systolic and diastolic blood pressure tests. Findings showa substantial and statistically significant difference in the body composition and physical performance of the experimental group than the controls. The experiment group displayed a reduction in the fat tissue and body fat after weeks of rigorous Karate training compared to controls. Further, for both the groups, the male participants showed a considerably higher and statistically significant anaerobic capacity and peak power than their female counterparts. The findings point to the conclusion that rigorous Karate training has a considerable positive impact on the body composition and related physical fitness of adults, with the males being more responsive than females. This study is, however, limited by low sample size and inability to account for environmental influences such as diet and lifestyles of the participants. Future studies should consider incorporating more controls and larger samples.

Keywords: Anaerobic Capacity, Karate, Physical Fitness, Wellbeing.

Introduction

The average American adult typically adds 0.5-1kg annually. This gain of weight, which usually is in the form of fat gain, culminates into a regularity of unhealthy obesity and weight with the increase in age. Researchers have shown that excess adiposity in the body, specifically additional abdominal fat leads to an increment in the individual risk of morbidity in relation to various ailments amongst such cardiovascular diseases (Ucan, 2014). Although the etiology of increasing rampancy of obesity is not clearly understood, there exist wide bodies of evidence that suggests a link amongst obesity and decreased physical activities. Reduced physical activity is mostly associated with substantive weight gain. Studies (Chyu et al., 2013; Kim et al., 2015; Ucan, 2014) have established different forms of exercise to benefit the proportion of fat and non-fat mass in the average adult's body. Amongst the various physical exercise programs that help the body composition is karate, as a form of martial arts exercise program (MAE). This study seeks to investigate the individual effects of 8-week Karate training on body composition and the body's physical performance in adults.

Methodology

The study adopted a randomized controlled trial (RCT) to achieve a more reliable outcome by comparing the control group with the experimental group.

Participants

All of the subjects that participated in the study were recruited via newspaper advertisements, local television, and using flyers. A total of 20 volunteers participated in the end of the 8 weeks exercise (Males =12, Females=8). The subjects of this study were selected randomly by the researchers to form two proportionate groups i.e., the

experimental group and the control group (n=10 in each group, males=6, females-4). The criterion for inclusion was adults over the age of twenty-five years that had an average body mass index (BMI) of above or equal to 25kg/m2. The average body mass index is chosen for this individual class of participants as per the World Health Organization standards and definitions of stable weight and overweight (Andrade, Andreato & Coimbra, 2019). Exclusion criteria for this select group of participants included such factors as any history of weight reduction surgery, any other forms of cancer amongst the patients, and uncontrolled terminal or concomitant ailments. Any participants amongst the volunteers that were found to be pregnant based on self-report and those that had any other forms of physical conditions that would prove to be a contradiction to the exercise were also excluded from the study. The control group for this individual research met and participated in every schedule designed for the study but did not engage in any form of physical activity or Karate training. On its part, the experimental group met as scheduled and engaged in the physical activity and karate training that was offered in every session through the eight weeks of training.

Tests

Consistent with Benito et al. (2020), the subjects of this study met for an hour in every session for a frequency of three meetings in a week. The tests were programmed to run consecutively for eight consecutive weeks. Every one-hour session in a week comprised of 10 minutes of warm-up activities, 40 individual minutes of Karate training, and an additional 10 minutes of relaxation exercises. Researchers subjected the participants to several vertical jump tests, handgrip strength tests, back-leg strengths test, and a series of flexibility tests.

The participants were also subjected to different forms of sprint tests heart rate tests, anaerobic power tests, amongst other systolic and diastolic blood pressure tests (Chyu et al., 2013). For the vertical jump tests, preferable results were recorded in the form of cm. The Takei Jumper meter was used by researchers to measure the athlete's vertical jump capacity. The measurement capabilities of the Takei Jumper capacity that was used in the experiment ranged from 5 cm to 99cm (Kim et al., 2015). For the Handgrip strength test, researchers used the Takei hand dynamometer for both the right hand and left hand of the participants. During the trial, the participants had to stand up upright without them bending their arms or contacting any part of their bodies. The participants of this experiment were also required to maintain a considerable distance between their arms and the dynamometer. The most desirable value was measured and recorded in terms of kilograms (Kg). For the back-leg strength test, researchers used the Takei Force dynamometer to measure the participants' leg and back strength. For this test, the participants had to complete their traction by bending their legs at an angle of 45degrees. The flexibility test was performed on the athletes' back and leg muscles using the sit-reach flexibility test (Haider et al., 2016).

For the second phase of the test, participants performed the sprint test with soccer players on a dirt surface. For this individual test, expected results were recorded using a photocell device that operated using light sensitivity. Soccer players were allowed to start racing 2 meters away from the set start line (Schare& Fish, 2018). For the individual resting heart rate test, participants had their heart rates recorded using individual electronic sphygmomanometer during the period that they were resting. It is at this time that a majority of their vitals were at a stable level. The individual Karate attendance for each participant was recorded so that the researchers could calculate the different vitals of each participant. Additionally, each participant was required to wear a heart rate monitor so that researchers could effectively quantify the individual intensity of the test and exercise in a bid of ensuring a moderate-intensity exercise workload. To effectively compare both the post-test and pre-test values of the subjects, researchers used the t-test for each individual group. They considered the most significant level to be $P<0.05$.

Findings

The participants to this individual exercise and test were asked about any occurrences of events such as malaise, pain, or any other serious condition during the test that might have served to influence the test. A majority of the participants were observed during the Karate exercise and test. The observation programs are in table 1. During the study, the participant's body composition amongst them the fat mass (FM), non-fat body mass, body weight (BW), and bone mass (BM) were determined using various bio impedance measurements (O' Conner, 2011). Such biomedicine measurements that were used for this experiment included the body composition analyzer. The

body mass of the participants was calculated in relation to the mass and height of the participants. The Takei Jump meters used in the experiment showed that a majority of the participants with a specific body mass and lipid profile could easily jump more than 10 cm off the ground (Seo et al., 2015). A majority of those that failed the vertical jump tests are the participants that had a BMI of more than 25kg/m2.

Only a limited portion of the test subjects were in a position to effectively execute the handgrip strength test at the beginning of the experiment. As time progressed and as the subjects performed more and more tests each week. More participants were able to complete the handgrip strength test efficiently, and the best values in terms of kilograms that had been recorded in the previous sessions increased gradually. Athletes performed poorly in the back-leg strength tests and the flexibility test at the commencement of the training.

A majority of the participants and mostly women whose body mass, body weight, and fat mass was slightly above the average recommended performed poorly as they were not able to maintain their traction while standing at an angle of 45 degrees (Ounis et al., 2010). With increased exercises and more Karate training, this group of the population was in a better position to stand at an angle of 45 degrees and maintain their traction. More karate training saw more participants pass their back-leg strength tests and flexibility test. The same results were recorded for all the other tests that were carried out in the Karate training and experiment. A majority of the participants recorded an improvement in various tests after more exercise sessions.

When it comes to the body composition of the participants in the Karate training, participants recorded a significant drop in the weight for both the male and female groups. From the statistics recorded from the measurement samples, the body fat percentage of males reduced from an aggregate of 11.4± 2.28% to stand at an estimated 9.9± 1.50% after eight weeks of Karate training.

For this same population of the participants, this individual percentage of fat tissue considerably decreased from an average of 8.1± 2.30kgs to stand at 6.8± 1.52kgs. On the other hand, the particular percentage of female body fat dropped from an average of 23.2± 3.58% to stand at a rate of 21.2± 3.09% after successful training. For the female group of athletes, their fat tissue also considerably decreased from an initial 14.0± 3.0kg to 12.4± 2.48 kg. Similar to the previous findings (Yap, 2016), for this test and practice, there appears to be no statistically considerable difference in terms of lean tissue for both the male and female populations of the experiment.

Unlike the female participants, the bone mineral content substantially increased in the male population during the eight weeks of training to stand at approximately 3, 049.53g up from an initial 3,031.1g. The bone density for the male category of participants was also recorded to be high from the initially recorded samples. For the eight weeks of training, there was a considerable difference in terms of physical fitness changes.

The results of power in relation to the standing long jumps and flexibility in regard to the sit and reach exercise were not much considerable for both the male and female populations. For the 30m sprint run, the male population recorded much higher agility and a positive effect when compared to their female counterparts. Though minimal, there was also a considerable increase in terms of agility for the female population in the 30m shuttle run. Men reported having higher muscle endurance than their female counterparts.

Table 1: Weekly Training Program for Experimental Group

	Program	Load	Time
Monday	Warm-up		10 minutes
	Sub maximum intensive workouts	70-85% >HRmax	40 minutes
	Flexibility, Karate Training		
	Cooldown		10 minutes
			10 minutes
Wednesday	Warm-up	60-80%> HRmax	40 minutes
	Moderate Long, slow distance workouts	20REP/3 set	
	Circuit training, Karate Training		10 minutes
	Cool down		10 minutes
		40REP/3 set	40 minutes
Friday	Warm-up		
	Sit-up and push up training exercise		10 minutes
	Karate Training		
	Cool down		

Karate training program Phase Technical and tactical training content

Week 1 and 2
Basic techniques including straight punches, kicks (front kick and sidekick) and defensives techniques (Slip left, right, lean backwards and Block) using different forms of steps (forward, back and at sideways).

Week 3 and 4
Pre defined simple technical combinations between punches and kicks by the commandment of the coach. Sparring drills: prearranged combat using techniques alternating the role of defending or attacking emphasizingon long distance combat.

Week 5 and 6
Improvement of offensive and defensive techniques used in nearby distance (Hook, role clockwise and anticlockwise).Sparring drills including attacking and counter attacking. Pre-arranged combat including emphasizing defence or attack for nearby distance.

Week 7 and 8
Shadow sparring using combined offensive and defensive techniques with free steps at different imaginary targets. Alternative technical exchange using predefined complex technical combinations by the command of the coach.

Circuit training includes chest-press, Biceps-Curl, Triceps extension, seated dip, shoulder press, real dip, and switch foot drill with a barbell, leg press, and leg extension with sit-up and push-up program.

The pre-test and post-test results are in table 2.

Table 2: Descriptive Statistics of Groups

	Group	Pre	Post	Δ %	Total value
BodyMass (Kg)	Male	69.8±9.46	68.6±8.40	-1.7	2.42
	Female	59.8±6.56	57.9±6.41	-3.2	3.01
Percentage of fat (%)	Male	11.4±2.38	9.9±1.50	-13.2	5.44
	Female	23.2±3.58	21.2±3.09	-8.6	4.06
Fat Tissue (Kg)	Male	8.11±2.30	6.8±1.52	-16.0	4.48
	Female	14.0±3.00	12.4±2.48	-11.4	4.93
Lean tissue (g)	Male	28.9±7.69	58.7±6.96	0.0	0.58
	Female	43.6±4.71	43.2±5.16	-1.0	0.95
BMC (G)	Male	3,031±401.41	3,049.8±403.53	1.0	-2.74
	Female	2,461.9±3,33.91	2,462.7±331.43	0.0	-0.06
BMD (g/cm2)	Male	1.29±0.09	1.31±0.10	1.6	-2.42
	Female	1.206±0.09	1.211±0.09	0.0	-0.83

Body composition

It is no doubt that body composition has a crucial role when it comes to defining a competent athlete (Allan & Laborde, 2014). Most importantly, the body composition of any given athlete or martial arts expert is related closely to their physical performance. On an athlete's body, their levels of body lipids or body fat coupled with aerobic and anaerobic affect their physical fitness factors. Such physical fitness factors include power and agility. The level of body lipids also affects other factors, such as a decrease in lean tissue amongst female athletes (Nicklas, 2010). In the study conducted on the Karate training, it was evident that the eight weeks of pre-season practice for both the male and female participants substantially lead to a decrease in the percentage of their fat tissue and body fat consecutively.

Nonetheless, despite registering a positive effect in the pre-season impact that had a considerable drop in the body's fat, the female category of the participants still recorded a relatively higher percentage of body fat in relation to other pro-athletes in the field of soccer. Although it might prove challenging to make a comparison of the body fat percentage of the participants to those of pro-athletes in soccer teams, the significant differences in the recorded proportions might be as a result of variances or errors in measuring instruments (Geirsdottir et al., 2015). The error might also be as a result of the soccer team's performance levels in relation to a specific team like the one used in the study above.

For both the male and female category of this experiment, there was no substantial difference or change in the participants' lean tissue. A different study conducted by Ellis (2020) indicated a considerable change in the lean tissue of professional wrestlers in their pre-season training. The body composition results that have been obtained in this particular 8 weeks of Karate training might effectively suggest that the practice did little in changing the lean tissue composition of the participants (Singhai, 2014). The training in itself presented minimal opportunities for lean tissue improvement. Results from other similar studies have indicated that weight training programs are ideally the best when it comes to a reduction or increase of muscular tissue in the body of athletes. In relation to other similar studies conducted in different fields of martial arts training such as Taekwondo and Judo, results indicated that it takes more than eight weeks and, most specifically, around twenty-four weeks for the inathletes to increase (Park, 2016). However, this individual Karate training presented results that were quite contrary to other studies conducted.

This study showed a substantial increase in the bone mineral content and related bone density for both the female and male athletes. The increase in bone density, which contradicts other studies, might be as a result of the individual biological makeup of the participants to this study when compared to the biological-maker up of the athletes in the different studies conducted (Gillen &Hausenblas, 2011). However, it not ideal for the researchers to

generalize the results obtained from the experiment, given that the population of the participants to this study was considerably small (N=20). There is a myriad of other factors that affect the increase or decrease of bone density in athletes. Factors such as the intensity of the training, the duration of the training, and gender are significant aspects in determining the improvement of an athlete's bone density. Such factors might have considerably influenced the outcomes of bone density research in other studies, which were mostly contrary to the results obtained in this individual experiment.

Physical Fitness

The participants of this Karate training maintained a considerably higher level of physical fitness training in relation to any other athlete. The vertical jump test and the 30m sprint tests that the athletes were subjected to played a significant role in influencing their physical fitness. The rigorous flexibility tests that the participants were subjected to most considerably served to strengthen their back muscles and leg muscles (Andrew et al., 2011; Gonzalez-Suarez, 2013). After a repeated session of the same exercise, the male category of the athletes reported having a considerable increment in their back muscles stronger than their female counterparts. This individual increment in the leg and back muscle strength of the male participants can be attributed to the genetic makeup of the male participants, which is considerably different for the female participants. The male participants also substantially recorded better performances in other physical performance tests in relation to their female friends as a result of their body morphology.

Among the controls and experimental groups in the Karate exercise, the male participants recorded a substantial improvement in their anaerobic capacity and peak power despite the considerable increment in peak power and the anaerobic capacity for the male participants; there was no substantial increment in the participants' lean tissue. The findings are consistent with past research (Babray&Lorimer, 2012). Typically, an increase in the muscular tissue of the participants requires an average time frame of three months. This individual Karate training only lasted for eight weeks. The results from the lean tissue performances of the athletes show that relative anaerobic capacity and peak power may considerably rise with a considerable change in with the difference in the lean body mass of the participants (Pierce & McWilliams, 2014). In any form of Karate training, the kicking velocity of the leg is substantial as the folding velocity of the same. Significantly, an athlete folds their leg after kicking.

Results obtained from the Takei Force dynamometer indicated that all the participants recorded a slight poor performance in kicking and folding velocity tests. Before commencing any form of martial arts training, the participants must engage in various types of supplemental training and activities that can serve to strengthen their flexor muscles(Gram et al., 2014). Improving the performance of the flexor muscles amongst the athletes considerably enables them to kick and fold quickly. The poor results recorded by the Takei force dynamometer indicate that there was no increase in lean tissue for both the right and left legs of the male participants (Ellis, Kosma& Downs, 2013). The same was true for the female participants, even though the female participants recorded a slight improvement in their kick and fold functionality, indicating that instead might have been a slight increase in lean tissue amongst this population.

Conclusion

This study sought to establish the individual effects of eight-week karate exercise and training on the athlete's body composition and physical fitness. It adopted a randomized controlled trial (RCT) where both the control and experiment groups were subjected to a rigorous exercise that meant to test different aspects of their body composition and physical fitness. The experiment group was given karate exercise, not available to the control group. Findings reveal that after an 8 weeks exercise, the experimental group had a considerably higher drop in the body weight, the percentage body tissue, and body fat. Further, gender is a significant factor that influences the body response to karate exercises- males show a significantly higher responsiveness, as compared to females. Unlike the female participants, the bone density of the male participant increased substantially for the male participants. Consequently, the study concludes that Karate training has a positive impact on the body's composition and related physical fitness, with the males being more advantaged given their swifter response rate. The evidence comes against the backdrop of alarming prevalence of lifestyle, weight, and respiratory-related

conditions, including obesity, overweight, hypertension, among others. Even as people resort to physical exercise as a preventive and corrective therapy that helps burn fats and improve life quality (Moratalla-Cecilia, 2016; Wilburn, 2016), it is important that they consider infusing karate exercises to fast track improvement physical health outcomes. In particular, those struggling with weight-related conditions (such as the obese) would realize a more accelerated weight reduction and better quality of life if they regularly used the karate exercise, in addition to other athletic activities.

This study has some methodological limitations that should be taken into account. First, it was impossible to track or control the adults' lifestyle, diet, and environment outside the training environment. Consequently, the findings failed to factor the influence of environmental conditions. The success of the trials solely relied on the goodwill of the participants. Despite some briefings to the participants in both groups, it is impossible to rule out the possibility of taking further exercises outside the training sessions. Future studies should investigate the role of environmental factors, including diet and other lifestyle conditions, in influencing changes in the body during a karate exercise. Further research should focus on the mechanisms through which karate exercise induces body changes and the relative impact of various forms of karate exercise. A compounding limitation is the low sample size (N=20), which exposes the study to some degree of errors of probability. A larger sample will also help in validating the present findings or further developments on the topic.

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