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Relationship between Judo Skills Acquisition Ability and Body Composition of Individuals at Different Growth and Development Stages

O. E. Nabofa

Exercise Physiology Unit, Department of Physical and Health Education,
Delta State University, Abraka, Nigeria
Telephone: 08036687464; E-mail: drnabofa@deltastate.edu.ng, coachnabofa@yahoo.com

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ABSTRACT Body composition, claimed to be predictive of sports performance ability and stage of growth and development, was assessed. Body composition of fifty untrained youths comprising of five boys and five girls purposively selected from five different stages of growth and development groups was assessed. The participants were trained in judo for three months and assessed for judo skills acquisition abilities by number of basic judo skills successfully executed and performance at the Nigeria National Open Senior and Junior Judo Championship of January 7th – 10th, 2008. Data obtained were analysed with the descriptive and inferential statistics of mean, standard deviation and Pearson correlation coefficient at 0.05 level of significance. Body composition was found to vary significantly with stage of growth and development, and judo skills acquisition ability. Body composition may therefore not be useful for predicting judo excellence especially among beginners.

INTRODUCTION

Every man is born with peculiar characteristics. These characteristics define the man's capabilities in life. The ability of any man to do physical activities was described by Wuest and Bucher (2003), as a measure of his physical fitness. The capabilities which a man inherited at birth from his parents were described by Igbanugo (2007), as that person's innate abilities or talents. This is why some people are born to be taller while others are shorter; some are stronger, while others are made to be able to sustain longer durations of physical exertions.

The concern of any coach is to seek out athletes with the greatest potential to succeed, and since it is clear that the innate ability of each athlete to adapt and respond to training will influence end results, it is necessary to identify people who are so genetically endowed (Perusse et al. 2001). Moreover, since many characteristics are beyond anything a coach may do in a training programme to change, the only way to success therefore rests with scientific testing to determine the necessary innate abilities. Explaining further, Igbanugo (2007) stated that the mature height of an athlete and other anatomical characteristics are not easily altered, and well- designed tests can accurately evaluate these characteristics. She concluded that with this kind of information, coaches can know exactly where to place budding athletes thus reducing a lot of volume of work for coaches while the athletes too can be guided towards sports from which they will gain maximum returns for their efforts while keeping them away from frustrating sports in which they are naturally limited.

Judo is a martial art sport designed by Jigoro Kano in the 19th century (1886 - 1936) from the more deadly martial art called Jujutsu. At the time of the introduction of Judo, serious injuries and deaths were common occurrences during martial arts competitions. Judo became very popular as its practitioners routinely defeated students of other martial arts without injuring or maiming anyone during the contests. This, according to Young (2002), was a demonstration that judo was not only a safe physical activity but also an effective means of defending oneself. He concluded that Judo became so popular that it was adopted into the curriculum of Japanese public schools in the 1880s and became an Olympic sport in 1964, when the Games were held in Tokyo.

Judo literally means the "easy way" or "the way of least resistance", because like water it uses the line of least resistance to overcome an

opponent (Hodges 1999). Judo training and competition emphasizes throwing an opponent to the ground by grasping his body or uniform. Once down, a variety of chokes and joint locks may be used to effect a submission (Young 2002). Skills in a sport of this nature, which includes the various techniques of throwing and restraining an opponent, makes use of appropriate grips, posture, push or pull for opponent's balance displacement and movement or mobility that enables one to throw or restrain an opponent (Weers 1997).

It should be possible to determine innate abilities that are congruent with excellent judo performance since it has been shown that there are several means of detecting innate abilities required for most sports (Nabofa 2011). The means for determining performance abilities in budding combat sport athletes (including judo) according to Kalina et al. (2005) comprises of anthropometric and physical measures of height, weight, body fat, lean body mass and somatotype plus other physiological measures. The measurement and analysis of body composition and physical characteristics of both successful senior and junior athletes within a specific sport have proved to be very useful in prediction of future excellent performance (Franchini et al. 2007). A similar view was expressed by Thomas et al. (1989) that some anthropometric variables should be considered as pre-requisites for high performance in judo competition.

This research was, therefore, set to assess some body composition parameters in selected untrained youths who have not been in contact with judo before and are at different stages of growth and development, teach these individuals the rudiments of the competitive sport, judo for three months and assess how well each was able to grasp the judo skills taught. It was assumed that the participants, being untrained youths from different family backgrounds and at different stages of growth and development, should in accordance with Malina and Bouchard (1991) possess different body composition profiles as genetically determined physiological changes. It was also hypothesized that if body composition can be useful in talent identification for the sport judo, then a distinct body composition profile would be found among those with better judo skills acquisition abilities after three months of judo training by the same coach.

METHODOLOGY

Research Design

The ex-post facto research design was used for this study. Kerlinger and Lee (2000) described ex-post facto research design as the design in which the events that are observed or measured, have indeed taken place already. This research design was deemed appropriate for this study since it had to do with the measurement and comparison of existing characteristics of anthropometric measures of body composition and level of judo skills acquisition of participants at different stages of growth and development; individuals at the junior primary school, senior primary school, junior secondary school, senior secondary and young university undergraduate stages of growth and development.

Sample and Sampling Technique

The sample for this study was made up of 50 participants comprising of 5 male and 5 female junior primary school children, 5 male and 5 female senior primary school children, 5 male and 5 female junior secondary school children, 5 male and 5 female senior secondary school children of the Delta State University Primary and Secondary schools and 5 male and 5 female young university undergraduates of the Delta State University who volunteered to participate. Care was taken to ensure that none of the participants had competed in any sport at any local, state or national level sport competition. All of them had little or no knowledge of judo. All the participants took part voluntarily in the study, after being informed about the procedures involved, and signing an informed consent form, either by themselves or for them by their parents in the case of the under-aged children. The Delta State University Medical Committee on Research using Human subjects gave the approval for this research.

Pilot Study

A pilot study was conducted prior to the main study to assess the feasibility of the research and to pre-test the instruments for measuring body composition. Though the instruments used for this study were validated and standardised instruments, their calibrations were cross-

checked to ensure that they were in proper working conditions. The pilot study also provided the opportunity for the researcher and his assistants to practice and familiarize themselves with the materials and methods used for the study. Ten final year students of the Department of Physical and Health Education who were not involved in the main study were utilized.

Procedure for Data Collection

Test Location: All measurements and training took place at the Exercise Physiology Laboratory of the Department of Physical and Health Education, Delta State University, Abraka, Nigeria.

Age: Each participant had his or her age in years recorded to the nearest birthday.

Body Composition Measurements

A standard electronic weighing scale (M 01-22-07-245; Secca brand) made in Hamburg, Germany, with a reliability coefficient of 0.96 (Watson 1993) was used to measure the total body weight or body mass of the participants in kilograms. Participants were weighed with minimal clothing. Values were recorded to the nearest 100g.

A Holtain Stadiometer (Crymych brand, made in the United Kingdom), with a reliability coefficient of 0.99 (Safrit and Wood 1995) was used to measure participants' stature or stretch height to the nearest 0.5cm. Each participant mounted the Stadiometer and kept his/her head in the Frankfurt plane. With two hands, the participant's head was stretched gradually until the full stretched height reading was obtained and recorded.

A Lufkin flexible steel tape (W606PM, made in the United Kingdom), with a reliability coefficient of 0.99 (Safrit and Wood 1995) was used for measuring girths. This tape was also used to accurately locate the sites for taking both the subscapular and supraspinale skinfolds.

A Broad Blade Anthropometer, calibrated in centimetres with millimetre graduations, which ISAK (2001) claimed has good reliability coefficient, was used to measure body breadths, at the following sites of the body; (i) Wrist (distal styloids) breadth (ii) Ankle (minimum) breadth (iii) Bi-epicondylar humerus breadth (iv) Bi-epcondylar femur breadth.

Lange Skinfold Caliper (model 3003, R = 0.88) manufactured by Cambridge Scientific Industries Incorporated, was used to measure skinfold thickness. The calliper was graduated from 0 to 67mm and had a constant pressure of 10g/mm. All skinfold measurement sites (triceps, subscapular, suprailiac, abdomen, thigh and calf) were marked first before measurements were taken. The skin at the marked point was gently rolled up and picked between the thumb and first two fingers of the left hand. Space was thus provided to fit the jaws of the calliper which was held on the right hand and used for measuring the skinfold thickness to the nearest 0.5mm. Care was taken to avoid picking any underlying tissue within the skinfold. Following the ISAK protocols, three measurements were taken and recorded. Technical Error of Measurement (TEM = 9.58%) was calculated from the closest two of the three measurements and was found to be within acceptable standards (Norton and Olds 1996). The mean of the two nearest measures were used for computation. The following equations by Whiters et al.(1987) were used for computing body density, percent body fat and lean body mass (or fat free mass):

Equation 1: Percent Fat Estimates of Male Athletes
Body density (BD) = 1.10326 - 0.00031 (Age) - 0.00036 (sum 6)
Estimated percent fat = (495/BD) - 450
Sum 6 = triceps + subscapular + supraspinale + abdominal + Front thigh + medial calf
R = 0.738
Equation 2: Estimating Percent Fat Estimates of Female Athletes
Body density (BD) = 1.07878 - 0.00035 (sum6) + 0.00032 (AGE)
Estimated percent fat = (495/BD) - 450
Sum 6 = triceps + subscapular + supraspinale + abdominal + Front thigh + medial calf
R = 0.841
Equation 3: Estimating Fat Free Mass or Lean Body Mass (FFM or LBM).
Body weight - Body weight x Est. % fat = FFM OR LBM

Judo Training and Skills Acquisition Ability

All the participants reported to the test location which was also used as the judo *dojo*, hall used for judo training, three times every week for the purpose of learning and practicing the sport judo. They were taught break-falls, throws, blocks and counter-throws, hold downs *(osai-*

komi) and escape from hold downs. They were also taught the various strategies for winning judo competitions by the same coach. They were however, not taught *chime waza* (strangulations) and *kansetsu waza* (arm lock), because *chime waza* and *kansetsu waza* are not allowed during junior judo championships in Nigeria.

The performance of the participants before and during the Nigeria National Open Senior and Junior Judo Championship which took place at Umuhia between January 7th and 10th, 2008 was used to score them as follows: Zero was awarded to a participant if he or she failed to perform any of the basic judo skills taught satisfactorily; 1 point was awarded to all participants who were able to perform the basic judo skills of break-falls, two hip, arm and foot throws each, effectively block pre-arranged hip, arm or foot throws, three basic hold downs *(osaikomi)* and escape from at least one of the hold downs; 2 points was awarded to any participant who qualified to compete and competed at the National Open Judo Championships; 3 points to any participant who scored a point but did not win any bout during the National Open Judo Championship; 4 points was awarded to any participant who scored and won a match but did not win any medal during National Open Championship; 5 points was awarded to any participant who competed, won more than one bout plus a National Open Judo Championship medal.

Procedure for Data Analysis

The descriptive statistics of mean, range and standard deviation were used in describing the variables. Pearson Correlation Coefficient was used to establish the relationship between judo skill acquisition ability and body composition and stage of growth and development stage. All analyses were done at the 0.05 level of significance in line with Zar (1999) using the Statistical Package for Social Sciences (SPSS) version 10.

RESULTS

The mean and standard deviations of participants' scores in body composition parameters and judo skills acquisition ability are shown in Table 1. The Pearson correlations (Table 2) between the judo skills acquisition ability score and body mass yielded a coefficient value of 0.309 which was significant (2-tailed) at 0.029. This significance value is lower than the 0.05 significance level set for this study. The finding here, therefore, was that there was a significant relationship between judo skill acquisition ability and one's body mass. The Pearson correlation between the judo skills acquisition ability score and stature yielded a coefficient value of 0.205 which is significant (2-tailed) at 0.153. This significance value is higher than the 0.05 significance level set for this study. The finding here, therefore, is that there was no significant relationship between judo skill acquisition ability and one's stature. The Pearson correlation between the judo skills acquisition ability score and arm span yielded a coefficient value of 0.186 which is significant (2-tailed) at 0.195. This significance value is higher than the 0.05 significance level set for this study. The finding here therefore was that there was no significant relationship between a player's judo skill acquisition ability and his/her arm span.

The Pearson correlation between the judo skills acquisition ability score and body density yielded a coefficient value of -0.446 which is significant (2-tailed) at 0.001. This negative coefficient has significance value lower than the 0.05 significance level set for this study. The finding here, therefore, was that there was a significant relationship between judo skill acquisition ability and a player's body density. The Pearson correlation between the judo skills acquisition ability score and percent body fat yielded a coefficient value of 0.454 which is significant (2-tailed) at 0.001. This significance value is lower than the 0.05 significance level set for this study. The finding here therefore was that there was a significant relationship between a player's judo skill acquisition ability and his/her percent body fat.

The Pearson correlation between the judo skills acquisition ability score and fat free mass yielded a coefficient value of 0.220 which is significant (2-tailed) at 0.125. This significance value is higher than the 0.05 significance level set for this study. The finding here, therefore, was that there was no significant relationship between a player's judo skill acquisition ability and his/her fat free mass.

The Pearson correlation between the judo skills acquisition ability score and body mass

Table 1: Descriptive statistics showing the mean and standard deviations of body composition and judo skills acquisition ability scores of the participants

Judo skill acquisition ability score		*Body composition parameters*							
		Body mass (kg)	*Stature (m)*	*Arm s Span (m)*	*Body density*	*Percent body fat*	*Fat free mass (kg)*	*Body mass index*	*Fat free mass/kg*
Satisfactorily demonst-	Mean	35.73	1.42	1.48	1.07	13.38	30.94	17.06	.8662
rated some of the skill	N	41	41	41	41	41	41	41	41
but could not qualify	Std. Dev.	12.60	0.18	0.22	0.004	1.85	10.92	2.54	.01848
for the National Open									
Qualified but could not	Mean	56.48	1.64	1.71	1.0655	14.60	48.44	20.63	.8540
score a point	N	5	5	5	5	5	5	5	5
	Std. Dev.	16.65	0.12	0.16	.00964	4.23	15. 50	4.31	.04220
Qualified and scored a	Mean	49.40	1.62	1.67	1.07	11.42	43.76	18.05	.8858
point(s) but could not	N	2	2	2	2	2	2	2	2
win a bout	Std. Dev.	24.89	0.21	0.31	0.00009	0.04	22.03	4.73	.00040
Qualified, won more than	Mean	48.70	1.46	1.55	1.0449	24.01	34.21	21.30	.7599
a bout plus a National	N	2	2	2	2	2	2	2	2
Open Judo Champion-	Std. Dev.	34.37	0.22	0.22	.03594	16.30	18.18	9.71	.16302
ship medal	Mean	38.87	1.45	1.51	1.0672	13.85	33.34	17.62	.8615
Total	N	50	50	50	50	50	50	50	50
	Std. Dev.	15.40233	0.18	0.22	.00845	3.78993	12.88911	3.30139	.03790

Table 2: Correlations (Pearson) between judo ability score and the body composition parameters of untrained youths at different stages of growth and development

Body composition		*Judo skill acquisition ability score*	*Stage of growth and development*
Body mass (kg)	Pearson Correlation	0.309*	0.910**
	Sig. (2-tailed)	0.029	0.000
Stature (m)	Pearson Correlation	0.205	0.903**
	Sig. (2-tailed)	0.153	0.000
Arm span (m)	Pearson Correlation	0.186	0.911**
	Sig. (2-tailed)	0.195	0.000
Body density	Pearson Correlation	-0.446**	-0.209
	Sig. (2-tailed)	0.001	0.145
Percent body fat	Pearson Correlation	0.454**	0.211
	Sig. (2-tailed)	0.001	0.141
Fat free mass (kg)	Pearson Correlation	0.220	0.906**
	Sig. (2-tailed)	0.125	0.000
Body mass index	Pearson Correlation	0.319*	0.767**
	Sig. (2-tailed)	0.024	0.000
Fat free mass/kg	Pearson Correlation	-0.454**	-0.211
	Sig. (2-tailed)	0.001	0.141

index yielded a coefficient value of 0.319 which is significant (2-tailed) at 0.024. This significance value is lower than the 0.05 significance level set for this study. The finding here, therefore, was that there was a significant relationship between a player's judo skill acquisition ability and his/her body mass index. The Pearson correlation between the judo skills acquisition ability score and fat free mass per kilogram of body weight yielded a coefficient value of -0.454 which is significant (2-tailed) at 0.001. This significance value is lower than the 0.05 significance level set for this study. The finding here, therefore, was that there was a significant relationship between judo skill acquisition ability and a player's fat free mass per kilogram body weight.

DISCUSSION

Persons at different stages of growth and development should have different body compositions in line with Malina and Bouchard's (1991)

position that children's body composition profiles changes along with other growth indices as genetically determined physiological changes due to the growth process. This point was established in the findings elicited from Table 2 which showed that the participants studied had body composition parameters that were significantly correlated with their stage of growth and development. Gallahue and Donnelly (2003) had insisted that any physical training that involves the use of complex motor skills such as found in judo must be age specific and stage of growth and development appropriate for it to be of any meaningful benefit. Nabofa's (2009) finding that the stages of growth and development most suitable to judo skills acquisition are those found among senior primary school girls and junior secondary school boys suggests that successful training in judo should start at these stages. It was, therefore, necessary to find out if there would be any significant relationship between factors, such as body composition, peculiar to these stages of growth and development and observed judo skills acquisition capabilities.

The Pearson correlation coefficients between judo skills acquisition ability scores of the participants and the participants' body composition parameters studied shown in Table 2 indicated that there were significant relationships between persons' judo skills acquisition ability and their body mass, fat free mass and stature. These significant relationships may not be useful in meaningfully establishing any relationship between persons at different stages of growth and development unless transformed into variables that would cancel out the influence of body mass on the results because judo is a weight classified sport where competition is only among persons within the same weight category (Kubo et al. 2006). Body mass, fat free mass and stature were transformed, in this study, to percent body fat, body mass index and fat free mass per kilogram body weight. The analysis of these variables as shown in Table 2 revealed also that there were significant correlations between judo skills acquisition ability scores of the participants and their percent body fat, body mass index and fat free mass per kilogram body weight.

These findings are in line with the findings of other researchers (Callister et al. 1991; Kubo et al. 2006) which suggested that body composition parameters may be useful in predicting future excellent performance in judo because higher level judo players were found to possess significantly lower percent body fat, higher fat free mass, larger circumferences, larger bone diameters. Considering the fact stated by Amusa and Abass (2002) that the longer a tissue is exposed to a training stimulus, the better it becomes, it is expected that the body composition parameters of the higher level players should be better than those of lower level players. The fact that higher level judo players were found to possess significantly lower percent body fat, higher fat free mass, larger circumferences, larger bone diameters, among others could have been due to the fact they have received more training than their lower level counterparts. The participants in this study though, have not received different amount of judo training loads because they are all untrained youths, could have participated in the group training at different levels of commitment. Therefore, the finding that their body composition was significantly related to their judo skills acquisition abilities was not surprising.

CONCLUSION

This research has demonstrated that body composition of individuals is significantly related to their stage of growth and development. Body composition differences accompanying changes in stage of growth and development was also found to be significantly related to judo skills acquisition abilities. Therefore, a person's ability to grasp judo skills was found to be significantly related to his or her body composition. The implication is that it may be possible to know if a beginner would do well in judo through the determination of his or her body composition.

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