A STUDY OF KIN ANTHROPOMETRIC CHARACTERISTICS AND PHYSICAL FITNESS VARIABLES TO IDENTIFY TALENT OF YOUNG MALE JUDOKAS OF RAJASTHAN

Singh S.[1], Bhardwaj R.[2*]

[1] Sher Singh , PET, , Govt. Senior Sec. School,39 H Burjewala, Srikaranpur, SriGanganagar, Rajasthan, India.

[2*] Rekha Bhardwaj, D.P.E, , Ch. B. R. G. Govt. Girls College, Sriganganagar, Rajasthan, India.

Physical fitness is a quality of life for a general person but for a sportsman it can be evaluated and described as under. a, General physical fitness b. Specific physical fitness. The general physical fitness is the overall fitness of a sports man and includes all the physical fitness components or abilities such as strength, speed, endurance, agility, flexibility and body constitution, Whereas specific physical fitness refers to the fitness that fulfils that pre-conditional requirement of a particular sport or event especially physique, growth, health age and various physiological demands in relation to anthropometrical attributes (Sodhi and Sidhu, 1984). In light weight category U-17 year, it was been found that Judokas and controls differed significantly in bone mass, muscle mass and fat mass except fat in heavy weight category only. Here it was found that Judokas were lesser in these components than there of the controls.

Keywords: Kin Anthropometry, Skin Fold, Sliding Caliper, Somato Type, Physical Fitness, Torso, Explosive Strength ,Strength Endurance, Co-Ordination, Anaerobic Energy

Corresponding Author	How to Cite this Article	To Browse
Rekha Bhardwaj, D.P.E, , Ch. B. R. G. Govt. Girls College, Sriganganagar, Rajasthan, India. Email: rkh_2711@yahoo.com		

The general physical fitness is the overall fitness of a sports man and includes all the physical fitness components or abilities such as strength, speed, endurance, agility, flexibility and body constitution, Whereas specific physical fitness refers to the fitness that fulfils that pre-conditional requirement of a particular sport or event especially physique, growth, health age and various physiological demands in relation to anthropometrical attributes.

Statement of the Problem

A study of kin anthropometric characteristics and physical fitness variables to identify talent of young male Judokas of Rajasthan

Aims and Objectives of the Study

Main aims and objectives of the present study were :-

01. Know the various anthropometrics characteristics of junior level Judokas in the different weight categories;

02. Know the status and dominance of various physical fitness variables of the junior Judokas in different weight categories;

03. The age based developmental trends of kin anthropometric characteristics and physical fitness variables in the different weight categories of Judo; and,

04. To obtain the data of anthropometrics and fitness variables to be used for framing norms for future Judokas of junior level.

Hypothesis

It was hypothesized that the study will help to explore the minimum standards in terms of various body measurements, physique, body composition etc. and will also give various scores for different fitness variables. It was further hypothesized that:

01. Judokas will have more significant difference as compare to control group on most of the physical fitness parameters.

02. There will be a significant difference among Judokas and control group on most of the kin-anthropometric parameters.

Significance of the Study

01. The study will be helpful to identify fitness requirements of Judokas before training them.

01. The conclusion of this study will help the coach, physical education teacher and sport scientist to know the dynamic relationship between different tests.

02. The results of the study will help coaches and trainers to design the training of Judokas for important on specific area.

03. On the basis of this study, the physical teacher and coach will be available to understand force resistance at speed in the game of Judo.

04. The JMG test will give feedback about aerobic and anaerobic capacity of Judokas.

05. This study also will put light on strength endurance capacity of Judokas.

06. This study will help his to know the body types of Judokas on the basis of anthropometric testing.

07. Coaches and physical education teachers will be benefited from this study by knowing the speed strength, endurance flexibility and coordination of Judokas.

Methodology

Subjects for the study were selected from the Rajasthan State Junior Judo Championship of under-20 age category. Those Judokas who qualified for quarter finals in this championship were the part of this study. Their age was ascertained from the school records and subjects who came without the school record; their age was ascertained from other acceptable records.

The data of the present study was collected under the following two heads:-
01. Anthropometric Measurements

02. Physical Fitness Variables

The standardized techniques were followed to obtain the following kin anthropometric measurement and Physical Fitness variables.

Weight Categories –
01. Light Weight Category = up to and including 60 kg.

02. Middle Weight Category = over 60 kg and including 75 kg.

03. Heavy Weight Category = over 75 and including 100 kg.

FORMATION OF AGE GROUPS

In the study, the Judokas of two age groups viz under-17 and under--20 were examined for their kin-anthropometrics characteristics and their physical fitness test. A total number of 85 Judokas were examined in the age group under-17 and 33 Judokas were studied in the age group under-20. Total number of Judokas was 118.

Distribution of Judokas U-17 Years (N=85) and U-20 Year (N=33)

Enclosed as Annexure 01

A total of 27 control subject were studied in the age group under-17 and 23 control subjects were studied in the age group under-20

Distribution of Control U-17 Years (N=27) and U--20 Year (N=23)

Enclosed as Annexure 02

Derived Variables:-
01. Height Weight Ratio :-

H.W. Ratio = Height (cm.)/ (Weight kg.)½
02. Body Mass Index :-

$BMI = Weight (kg.)/(Height mt.)^2$
03. Body Composition :-

- To estimate the body fat body density has been calculated by using Durnin and Womerseley's (1974)

Equation as mentioned below

Body density for males (age group) = 1.1610-0.632 log (biceps + triceps+ sub scapular + supra iliac skin folds)

Body density calculates with the help of mentioned equation was converted to present body fat by using the formula by brozek et.al. (1963) or Siris equation (1956) i.e.

Percentage body fat = [(4.457/body density) - 4.142] X 100

(Ii) To estimate muscle and bone masses, Matiegka's (1921) formula has been used. The bone mass calculated by using the following equation.

Weight of bone or OSSA (in kg)

$= \{(HB+KB+WB+AB)/4\}^2 \times HT. \times 1.2 \times 0.001$

When HB = the maximum diameter of Humorous (cm)

FB = the maximum diameter of Femur (cm)

WB = the maximum diameter of Wrist (cm)

AB = the maximum diameter of Ankle (cm)

HT = the body height of the subject

(Iii) Muscle Mass: - The muscle mass was estimated by using the formula given by Matiegka's (1921)

$Muscle Mass (kg) = [CDU + CDV + CDT + CDC/4]^2 \times HT(cm) \times 6.5 \times 0.001$

Where CDU = max. Upper arm girth - Bicep sf (cm) + Triceps

$CDF = max. Fore arm girth - forearm sf (cm)$

$CGT = mid. Thigh girth - mid thigh sf (cm)$

$CDC = max. Calf girth - mid calf sf (cm)$

Remainder mass

RM = weight (kg) – Bone mass – Muscle Mass - fat mass

TOOLS USED

Anthropometric Measurement

A total of twenty anthropometric measurements were taken on each subject following the standardized techniques of Martin & Seller (1957) and Sodhi (1991) The investigator had sufficient training of taking anthropometric measurement before starting the present research investigation.

The following anthropometric measurements were taken on each subject with care and precision:-

01. Age (years)

02. Body Weight (Kg)

III. Body Height (cm)
01. Hummers bicodylar diameter (cm)

02. Wrist Width (cm)

03. Femur bicondylar diameter (cm)

VII. Ankle Width (cm)

VIII. Upper arm circumference (flexed) (cm)
01. Upper arm circumference (relaxed) (cm)

02. Fore arm (Cir.) (cm)

03. Thigh " (cm)

XII. Calf " (cm)

XIII. Biceps Skin folds (mm)

XIV. Triceps " (mm)
01. Fore arm " (mm)

XVI. Sub scapular " (mm)

XVII. Supra iliac " (mm)

XVIII. Supra spinal " (mm)

XIX. Thigh " (mm)
01. Calf " (mm)

Above measurements helped to find out various lengths, breadths, circumferences, indices and proportions of the body of male Judokas. Further, various components of body composition viz. muscle mass, fat mass, bone mass and remainder was also assessed by studying the above measurements. Heath Carter (1967) method was used to evaluate the physique of each male Judoka player. Kroop's type weighting machine was used for taking the body weight of the subject. The linear measurement was taken with anthropometric rod. All widthwise measurements were taken with the sliding caliper. All circumferences were measured with the help of steel tape. The skin fold was measured with the help of skin fold caliper.

Physical Fitness Variables:-

A total of seven performance tests were administered to evaluate the performance level of subjects. The list indicating the name of performance test along with its application was:-

Name of the Performance Test-
Application
01. 30 meters : Speed

01. Standing Broad Jump : Explosive Strength of Legs.

02. Forward Bend and Reach : Trunk Flexibility

03. Pull-ups : Strength Endurance of arms

04. 6 x 10 m Shuttle run : Co-ordination / Agility

05. 60 Meter Dash : Endurance

06. J.M.G. : Force Resistance in terms of

Speed under the condition a

Mixture of aerobic and

Anaerobic energy.

All these test comes under AAPHER test of battery (except the test at No. 7) and were applied by observing the standardized procedures. All the subjects and concerned officials were given prior information regarding the tests being conducted.

Test J.M.G., Jose Mannel, GARCIA (NANO)

The test is composed of three exercises, each lasting one minute (total three minutes). The aim of the test is to measure force resistance in terms of speed under the condition of obtaining a mixture of aerobic/anaerobic energy.

The test subject must try to execute the highest number of repetitions possible of each exercise without rest between one exercise and another.

EXERCISES: The Tunnel, Sit-ups (abdominals), Jumping from one side to the other of a bench (the bench is 30cm in height).

Analysis

The test JMG is an evaluation technique specifically designed for those sports where force resistance at speed is an important element of the sport as is the capacity to carry this out effectively.

The test is based on the capacity to produce a mixture of aerobic and anaerobic energy and to correlate of obtaining energy with force resistance at speed while performing the three exercises that make up the test lasting three minutes. (One minute for each exercise).

On studying the recuperation curve that follows the test an indicator of the aerobic capacity of the test subject can be seen as well as the other results obtained during the recuperation period. (Three minutes following the end of the test)

The following data are necessary to establish the ratio JMG.

P1 -   Cardiac rate at the moment of finishing the test.

P2 -   Cardiac rate a minute after finishing the test.

N0 Rpt -Number of complete repetitions executed. (The total of the three exercises)

Kg -   Weight in kilograms

Age -   Age of test subject

The following equations are used when obtaining the ratio JMG.

A = $[(P1+P2)/2] - (n0\ rpt + Kg/2)$

B = $[K- (P1-P2)/2] - (n0\ rpt + Kgs/2)$

Thus resulting in the ration JMG = $(A+B)/2$

K is considered to be a constant (220-age) In different studies carried on elite sportsmen there was a tendency for this factor to be the number 200.

The results of the ratio JMG give a clear idea of the functional state of the competitor from the point of view of the above mentioned facts. Negative results of the ratio JMG (for example-30) indicate a good aptitude of force resistance at speed while obtaining aerobic - anaerobic energy. On the contrary, positive results (for example +30) give us an indication of poor aptitude.

The following results give us an idea of the degree of aptitude:

>-50   Excellent

 -40   Very good

-30   Good

-10   Quit good

 0   Fair

+30   Bad

+10   Not   very good

>+50   Very bad

This test has been used since 1982 and has been included in the testing of performance in many National Federations especially Judo. The results coincide favorably with various laboratory controls and remain true with the specific performance of Judokas in competitions of the highest category. It is difficult to find Judaist evaluated during a competitive period being winners of important competitions with a test result of below - 50.

Breaking down the equations necessary to obtain the ratio JMG we can see that in equation A, the values that give us the factor (P1+P2)/2 are going to be related with the intensity of workload evolved by the test subject during the test. This refers to an element relative to the intensity on the test.

The element "n0 rpt"(number of repetitions) refers to the capacity of the muscles to resist highly intense activity for the three minutes that the test lasts, under a situation of aerobic/ anaerobic energy production. Thus we are given a subjective idea of the level of coordination and agility of the sportsman during the test.

The first factor of equation B, [K- (P1-P2)/2], indicated the results related to the recuperation capacity of the test subject. This information can be seen to a greater extent if the cardiac rate recovery curve and the "rlx" of the test subject during the recovery period (three minutes) at the end of the test are studied.

The two equations combined show that the test, apart from showing us the aspects already described, give us an indication of the capacity of resistance of the subject, particularly of his/her mixed resistance, Therefore the test is appropriate for noncyclical action and team sports based on a resistance of base 3 as a test of resistance it is more specific for being based on non-cyclic exercises rather than on cyclic actions that are found specifically in sports such as running, cycling or rowing.

Finally, this test is usually accompanied by a valuation of the fatigue level of the subject showing itself at the end of the test on the Borg Scale.

STATISTICAL PROCEDURE

The raw data, which are given in appendix were statistically treated for the following tests

In order to observe reliability, significance etc. with and within different variables:-

01. Mean, Standard Deviation

02. Test of Significance ('t' test)

03. ANOVA and Post Hoc Test (between different weight categories of Judokas

Analysis of Data and Results of the Study

The Results of the present study have been discussed as:

- In light weight category U-17 year, it was been found that Judokas and controls differed significantly in bone mass, muscle mass and fat mass except fat in heavy weight category only. Here it was found that Judokas were lesser in these components than there of the controls.

- Light, middle and heavy weight categories of U-17 years Judokas did not differ in height weight and HWR except light weight category in HWR only where as controls were found to be lighter than Judokas .

- Judokas in general did not differ from controls in somatotype components in U-17 weight category except ectomorphy in light weight category and endomorphy in heavy weight category. Here Judokas were lesser than there of controls.

- It was found that combined Judokas U-17 weight category did not differ in HWR, bone mass, muscle mass, fat mass and somatotype components from there of controls.

- Light, middle and heavy weight categories of U-20 years Judokas were not different from controls. Except height and HWR in middle weight category, it was found that controls were taller and lighter than Judokas .

- Light, middle and heavy weight categories Judokas of U-20 years had not been different from control in bone mass, muscle mass, fat mass and somatotype components except ectomorphy and mesomorphy in middle weight category only than that of control.

- 20 years Judokas when taken together did not differ from controls except in ectomorphy. The findings revealed that Judokas were lesser at this component than the controls.

- It was found that Judokas light weight category

- of U-17 and U-20 age groups were the youngest and of middle weight category were the oldest. This study had formed that the weight of Judokas increase in order of ascending order of weight category and the same results were given by control group when the height was considered. Judokas have found to be shorter than control groups in both age and all the weight categories.

On 30meter run, results had shown the contradiction to the hypothesis of study where Judokas were found to be very poor on speed. When pull up results were taken Judokas had performed significantly better on 6×10 meter shutter run than control groups. U-17 middle weight category Judokas are found to be poor on FBR which meant poor trunk flexibility and hamstring stretch ability. This study reveled that the explosive leg strength of Judokas and control group remained almost the same. The study revealed that heavy weight category Judokas of U-17 and U-20 had shown poor results on 600 meter and JMG respectively.

Annexure

Annexure 01

Weight Category	No of Judokas	
	Under-17	Under-20
Light Weight	53	16
Middle Weight	22	7
Heavy Weight	10	10

Annexure 02

Weight Category	No of Judokas	
	UNDER-17	U20
Light Weight	20	11
Middle Weight	03	07
Heavy Weight	04	05

Reference

Ackland, T. R. , Schreiner, A. B. *and Kerr, D. (1997) Absolute and Proportionality Characteristics of World Championship Female Basketball Players. Journal of Sports Sciences, 15 (5) : 485-90 [Crossref]*

Ajan, Tamas and Baroga, Lazar (1988) Weightlifting, Fitness for All Sports, Published by International

Weightlifting Federation. P 62-75. . *and Kerr, D. (1997) Absolute and Proportionality Characteristics of World Championship Female Basketball Players. Journal of Sports Sciences, 15 (5) : 485-90* [Crossref] [Crossref]

Ahuja, R. and Goswami A. (1994). Cardiac Output of Elite Indian Weightlifters. *NIS Scientific Journal, Vol. 17(1)* [Crossref]

Astrand, P. O. (1956). Human Physical Fitness with Special Reference to Sex and Age. *Physical Rev. 306-308* [Crossref]

Bajpai, V. and Uppal, A. K. (2003) Physique, Measurements and Swimming Performance. *Bangladesh Journal of Sports Science. Vol.3 (1): 34-40* [Crossref]

Baroga Lazar (1977) Proceedings of the Weightlifters Symposium Published by International Weightlifting Federation, Budhapest, Hungary. . . (2003) Physique, Measurements and Swimming Performance. *Bangladesh Journal of Sports Science. Vol.3 (1): 34-40* [Crossref] [Crossref]

Bayley, N. and Pinneau, S. R. , (1952). *Tables for Predicting Height from Skeletal Age : Revised for use with Gruelieh Pyle hand standard. Jr. Pediatr. 40, 423* [Crossref]

Cratty, B. J. and Henin, Y. (1989), The Athlete in the Sports Team. *Social Psychology Guidelines for Coach and Athletes. Denever : Lover Publication* [Crossref]

Charke, K. S. (1972). Predicting Certified Weight of Young Wrestlers; A Field Study of the Teheng-Tipton Method, Med, Sci. *Sports, 552-556* [Crossref]

Claessens, A. , Beunen, G. , simons, J. , wellens, R. , *Geldof, D., and Nujts,M. (1986) Body structure, Somatotype and Moter Fitness of Top Class Belgian Judoists, in Perspectives in Kinanthropometry (Ed. AP.Day). Human Kineties Publishers, Champaign, Ilienis, PP. 155-163* [Crossref]

Chovanova, E and Zepletalovam, L. (1980) Size and Body Proportion of Young Czechoslovak Basketball Player Antropologiai Kozlemngek, 24, 239-44. . *, Geldof, D., and Nujts,M. (1986) Body structure, Somatotype and Moter Fitness of Top Class Belgian Judoists, in Perspectives in Kinanthropometry (Ed. AP.Day). Human Kineties Publishers, Champaign, Ilienis, PP. 155-163* [Crossref] [Crossref]

Demeter, A. (1981) : Sports in Wachstums and Entwick Mungsalter. Johann Ambrosium Barth. Leipzig. [Crossref]

De Garay, A. L. , Levine. L and Caster. *J.E.L.(1974) "Genetic and Anthro-Pologic-al Studies of Olympic Athletes." London Academic Press. p. 189* [Crossref]

Durmin, J. V. G. A and Rehaman, M. *M. (1967) "The Assessment of the Amount of Fat with Human Body from Measurement of Skinfold Thickness" British Journal of Nutrition 21: 681* [Crossref]

Eiben, O. G. (1979) Functional biotypology in Hungary, Opening lecture at 2nd Int. symp. *On human biology, Viegard* [Crossref]

Espenschade, A. (1963) "A Study of Relationship between Physical. . symp. *On human biology, Viegard* [Crossref] [Crossref]

Performance of School Children and Age, Height and Weight. "Research Quarterly 34 : 144. . *On human biology, Viegard* [Crossref] [Crossref] [Crossref]

Espenchade, A. (1963) : Restudy of the Relationship between Physical Performance of School Children and Age, Height and and Weight. Res. Quarterly. *43:144* [Crossref]

Fleck, S. J. (1983). Body Composition of Elite American Athletes, Am. *J. Sports Med., 11 (6), 398-403* [Crossref]

Hari Singh and Surender Kumar (2009). Aggression Among Judokas of All India Inter-University and Inter-College Level. Journal of Sports and Sports Sciences, Vol. 32 (4) : 5 to 12. *[Crossref]*

Hebbelink, M. (1985), Selected Anthropometric Characteristics of Montreal Olympic Athletes. J. Sports Physical Edu. *And Sports Sciences 12-16* [Crossref]

Heath, B. H. and Carter J. E. *L. (1967) A Modified Somatotype Method. Am. J.Phys Anthrop. 27:57-74* [Crossref]

Harre, D. (1987): Trainingslehre. Sportverlag, Berlin. *[Crossref]*

Harre, D. (1979). Training Lehre. Sport Verlag, Berlin, Germany. *[Crossref]*

Harre, D. (1982) : Principles of Sports, Training, Sports Vulog, Berlin 23-24. . *[Crossref] [Crossref]*

Singh, M. , Kadhim, M. M. , Turki Jalil, A.

Et al. A systematic review of the protective effects of silymarin/silibinin against doxorubicin-induced cardiotoxicity. Cancer Cell Int 23, 88 (2023). https://doi.org/10.1186/s12935-023-02936-4 https://cancerci.biomedcentral.com/articles/10.1186/s12935-023-02936-4 [Article][Crossref]

Mandeep Singh Nathial, Analysis of set shot in basketball in relation with time to perform the course and displacement of center of gravity, American Journal of Sports Science, Vol. 2 Issue. 5 pp: 122-126 (2014). Retrieved from https://www. *sciencepublishinggroup.com/journal/paperinfo.aspx?journalid=155&doi=10.11648/j.ajss.20140205.13* [Crossref]

Mandeep Singh (2010). Evaluation And Improvement Of Sports Techniques Through Biomechanical Updated Analyzing Technology, University News, Journal of Higher Education Association of Indian Universities, Association of Indian Universities, Vol:48:Issue. 05;2010 Pp45-57, 2010. *sciencepublishinggroup.com/journal/paperinfo.aspx?journalid=155&doi=10.11648/j.ajss.20140205.13* [Crossref] [Crossref]

. . 05;2010 Pp45-57, 2010. *Sciencepublishinggroup.com/journal/paperinfo.aspx?journalid=155&doi=10.11648/j.ajss.20140205.13* [Crossref] [Crossref] [Crossref]

Sharma, S. S. and Dixit, N. K. *(1985) Somatotype of Athletes in their Performances. Int. J. Sports med. 6:161-162* [Crossref]

Singal, P. , Bhatnagar, D. P. and Dhillon, S. *(1993). Intersportive Differences in Anthropometric Measurements and Body Composition of National Level Women, Ind. J. Sports Sc. Phy. Edu. 5(2) : 74-83* [Crossref]

Shealy, J. E. , Ettlinger, C. F. *, and Johnson, R.J., (2005), How Fast do Winter Sports Participants Travel on Alpine Slopes. Retrieved on 23 March, 2009, from www.astm.org/journals/ jai/pages/922.html* [Crossref]

Sidhu, S. , Herm, K. P and Sodhi, H. S. *(1989). Somatotype of State Level Women Participants of Hockey, Basketball, Volley Ball and Athletics Using Conrad's Method. Ind. J. Sports Sc. 1, (2), 41-50* [Crossref]

SINGH SIDHU, A. , & SINGH,

M. (2022). KINEMATICAL ANALYSIS OF HURDLE CLEARANCE TECHNIQUE IN 110M HURDLE RACE. *International Journal of Behavioral Social and Movement Sciences, 4(2), 28–35. Retrieved from* [Article][Crossref]

Singh, A. , & Singh , D. M. (2013). *PROMOTION OF RESEARCH CULTURE –ENHANCING QUALITY IN HIGHER EDUCATION. International Journal of Behavioral Social and Movement Sciences, 2(2), 202–208. Retrieved from* [Article][Crossref]

SINGH, M. , & SINGH SIDHU, A. (2016). A COMPARATIVE STUDY OF BODY COMPOSITION AND RELATIVE HEALTH STATUS AMONG RESIDENT AND NON-RESIDENT STUDENTS IN DIFFERENT SCHOOLS OF J&K. *International Journal of Behavioral Social and Movement Sciences, 5(3), 08–13. Retrieved from* [Article][Crossref]

Singh Nathial, D. M. (2012). ANALYZING THE CREDIT BASED SYSTEM IN PHYSICAL EDUCATION. *International Journal of Behavioral Social and Movement Sciences, 1(3), 172–176. Retrieved from* [Article][Crossref]

SHARMA, N. P. , & SINGH, M. (2014). *SENIOR AGE GROUP RELATIVE EXERCISES AND IMPACT ON THEIR LIFESTYLE. International Journal of Behavioral Social and Movement Sciences, 3(04), 78–82. Retrieved from* [Article][Crossref]

CHAND PURI, P. , MISHRA, P. , JHAJHARIA, B. , & SINGH, M. *(2014). COORDINATIVE ABILITIES OF VOLLEYBALL IN DIFFERENT AGE GROUPS: A COMPARATIVE STUDY. International Journal of Behavioral Social and Movement Sciences, 3(3), 56–68. Retrieved from* [Article][Crossref]

Shizo Takagaki and Harold. e. Sharp (1973). Technique of Judo: Introduction Part I PP. *1-2* [Crossref]

Vorobyev A. N. (1978). Text Book of Weightlifting, Published by International Weight Lifting Federation, Budhapest, Translated from Russian by Jeffery Brice P 213-215, 247-248. *[Crossref]*

Weiner, J. S. and Lourie, J. A. *(1969) Human Biology : A guide to field Methods Blackwell, Scientific Publicatiion, London* [Crossref]

Withers, R. T. Whittingham, N. O. *, Nortan, K.l. and Dutton, M. (1987) Somatotypes of South Australian Female Games Players. Human Biology, 59, 575-87* [Crossref]

Withers, R. T. (1987), Somatotype of South Australian Female Games Players. Human Biology, 59:575-87. *[Crossref]*

Wilmore, J. H. (1992) Body Composition and Body Energy Stores, In: R. J. *Shepard & P.O. Astrand (Eds.) Endurance in Sport (pp.244-255), London; Oxford Blackwell Scientific Publications [Crossref]*

Ward, T. , Groppel, J. L. and Stone, M. *(1979) Anthropometry and Performance in Master and First Class Olympic Weightlifters, J. Sports Med, (19). pp. 205-212 [Crossref]*

Xiong, Zhang, Jing (1985) "The Relationship Between Dropping Method in Chinese Wushu, Wrestling and Ukemi in Judo. " Abstracts sommaire of Universiade 'Kobe' 85. Organising Committee for the Universiade Kobe,. *[Crossref]*