



СПОРТНА ПЕДАГОГИКА

SPORTS EDUCATION

COMPARATIVE ANALYSIS BETWEEN CHINESE MALE  
AND FEMALE JUDO ATHLETES FROM AMATEUR  
AND PROFESSIONAL LEVELS THROUGH VARIOUS MOTOR TESTS

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**Abstract:** *The aim of this study was to examine the differences in anthropometrics and various motor skills in Chinese amateur and professional level judokas from different genders. For the investigation total of 37 athletes, amateur (male (n=10), aged 15.26±1.6), female (n=3), aged 16.27±0.7) and professional (male (n=17), female (n=7), aged 18+) Participating athletes underwent a comprehensive testing procedure, encompassing assessments for height, weight, a 30-meter sprint, 1RM Bench Press, 1RM Squat, Isometric Hold using Judogi, Ab Hold, and Biering-Sorenson Hold. The results showed that professional judokas were heavier than their amateur counterparts, and performed better in the 1RM bench press, 30-meter sprint as well as in the Ab Hold test. Overall, this study provides insight into the understanding of physical differences between amateur and professional level judokas, offering information that may have implications for further training and development of upcoming athletes in this sport.*

**Keywords:** *Chinese judo athletes, Professional, Amateur, Strength, Speed, Grip.*

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## Introduction

Judo, originating in Japan, has evolved into a global Olympic sport known for skillful throws and strategic maneuvers. Coined as the “gentle way” by founder Jigoro Kano, it emphasizes using the opponent’s force to advantage. Judokas showcase a blend of attributes like strength, endurance, speed, and agility. International bouts last up to 5 minutes, with ties resolved through a “golden score” period. Judo is a dynamic, high-intensity sport with competitions lasting 3 minutes on average. Structured into seven weight categories for both genders, major events like the Olympics and World Championships shape the landscape of judo competitions (Franchini et al. 2011).

Judokas heavily depend on strength as a biomotor quality, especially in the ability to gain better positioning and have control over the opponents. The constant need for throws (Uchi-Mata), twists and change of position, and groundwork (ne-waza) are characteristic of this sport which heavily relies on the ability to control pace by showing strength.

In practice, numerous tests are employed, such as, for instance, in assessing maximal strength, the commonly used test is isometric mid-thigh pull (IMTP) with the barbell positioned halfway between the anterior superior iliac spine and the patella (Giles, Lutton & Martin 2022). Meanwhile, laboratory conditions often utilize isokinetic dynamometers for the same purpose (Perrin 1993). Additionally, the well-established one-repetition maximum (1RM) testing is prevalent, particularly in exercises like squats and bench presses (horizontal presses), along with derived variations for less experienced practitioners – 3RM and 5RM, (Morales & Sobonya, 1996). Through formulas and conversion tables, the projected 1RM is obtained from these variations, contributing to a comprehensive evaluation of an individual’s strength capabilities (Grgic et al. 2020).

Furthermore testing for strength and/or endurance in handgrip has already been present in the literature showing differences between elite and non-elite judokas (Bonitch-Góngora et al. 2017).

Speed testing in combat sports, particularly in judo, is relatively uncommon, and research comparing the speed of elite and sub-elite judo athletes is scarce. The rarity of speed assessments in judo can be attributed to the sport’s emphasis on a combination of strength, agility, and technical skill rather than linear speed alone. Traditional speed testing may not capture the intricate movements and rapid changes in direction inherent to judo. However, exploring speed in judo athlete profiling could provide valuable insights into the efficiency of movement execution, reaction times, and overall performance. Integrating speed assessments into the profiling of judo athletes could contribute to a more comprehensive understanding of the physical attributes crucial for success in this dynamic and skill-intensive sport.

The robust trunk musculature in judo serves as more than just physical strength; it functions as a dynamic center influencing multiple factors crucial for athletic performance. Despite the need of maximal strength and power, two motor components dominated by the anaerobic system, aerobic capacity also prevails in competitions that last anyway from 1 to 5 minutes (Julio et al. 2017). One such quality is strength endurance which is a characteristic of the ability of the muscles to create the minimum force needed for a prolonged period of time (Ren et al. 2023). Tests such as Isometric Abdominal Hold, Biering-Sorenson Test, Plank, Side Plank, Sit-Ups for time (Wood 2008), have been widely used as cost-effective methods for testing the core in judokas (Yasul et al. 2023).

Testing motor capabilities can also serve for comparison between teams, genders, and in-between sports. Accordingly, comparative analyses are being prepared comparing young athletes with elite ones (Harat & Kislev-Cohen 2023; Loturco et al. 2020; Marinho et al. 2016; Norjali et al. 2017).

As studies comparing male and female judokas from amateur and professional levels are limited, this study is to explore the differences between genders and levels through anthropometrical and motor tests.

## Methodology

A total of 37 participants, male (n=10) and female (n=3) amateur judokas from the First Elite Sports School in Shanghai, and male (n=17), and female (n=7) professional level Judokas from the Shanghai’s First Professional Line have taken part in this study.

Both groups of athletes were in their preparatory period, involved in 6 days per week of judo training and 2–4 days of strength & power training. Before the participation in this study, all athletes were informed about the nature and risks of the experiment. Written, informed parental consent as well as participant assent was collected for the study participant.

Height and Weight measurements were done based on procedures outlined in the Anthropometric Standardization Reference Manual (Lohman, Roche & Martorell, 1988).

1RM Bench Press (1rm\_bench) and Squat (1rm\_squat) tests were done according to guidelines given by NSCA (National, Conditioning, & Miller, 2012).

Furthermore, 30-meter sprint (30m\_sprint), Isometric grip test using Judogi (**pullup\_judogi\_iso**), Isometric Abdominal Hold (Ab\_hold), and Biering-Sorenson Test (back\_hold) tests were carried out.

### Statistical Analysis

Data processing for this study utilized the statistical package IBM SPSS Statistics 26 in Chicago, IL, USA. A comprehensive descriptive analysis was performed to outline key features of the dataset. Measures including mean and standard deviation were computed to summarize central tendencies and variability within the variables of interest. Following the descriptive analysis, a Shapiro-Wilk Test was executed to assess the normality of the data. Subsequently, an independent sample Student's T-test was employed to compare levels between genders, with significance levels set at ( $p < 0.05$ ).

## Results

**Table 1.** Descriptive Statistics & Student's T-Test: ab\_hold (Isometric Abdominal Hold), back\_hold (Biering-Sorenson Test) – Male

VARIABLES	Amateur		Professional		95% CI for Mean Difference		
	Mean	SD	Mean	SD	t	df	p-value
Age	15.26	1.64	18+	/			
Height	178.340	4.6321	180.471	6.5776	-0.898	25	0.378
Weight	61.220	6.5173	88.176	20.6223	-3.989	25	0.001*
1rm_bench	77.350	16.3606	107.647	14.3742	-5.028	25	0.000*
1rm_squat	112.50	22.267	149.47	22.880	-4.094	25	0.000*
pullup_judogi_iso	27.90	7.838	36.53	12.304	-1.985	25	0.058
30m_sprint	4.69710	0.375604	4.28235	0.276553	3.295	25	0.003*
ab_hold	67.50	18.692	116.65	7.681	-9.643	25	0.000*
back_hold	134.80	32.183	136.00	23.233	-0.112	25	0.911

\* $p < 0.05$  statistical significance

Based on results in Table 1 in male judokas between levels there were significant differences in weight ( $p = 0.001$ ), 1rm\_bench ( $p = 0.000$ ), 1rm\_squat ( $p = 0.000$ ), 30m\_sprint ( $p = 0.003$ ) and ab\_hold ( $p = 0.000$ ).

**Table 2.** Descriptive Statistics & Student's T-Test: ab\_hold (Isometric Abdominal Hold), back\_hold (Biering-Sorenson Test) – Female

VARIABLE	Amateur		Professional		95% CI for Mean Difference		
	Mean	SD	Mean	SD	t	df	p-value
Age	16.27	0.7	18+	/			
Height	162.100	7.7208	170.714	2.4976	-2.821	8	0.022*
Weight	58.833	8.8951	63.857	9.1548	-0.801	8	0.446

1rm_bench	64.333	25.3246	62.143	9.5119	0.210	8	0.839
1rm_squat	111.00	25.159	88.57	6.901	2.334	8	0.048*
pullup_judogi_iso	28.67	5.033	26.57	4.962	0.610	8	0.559
30m_sprint	5.14133	0.232801	4.96429	0.156722	1.435	8	0.189
ab_hold	62.33	4.041	103.43	5.884	-10.864	8	0.000*
back_hold	124.33	7.095	157.71	27.879	-1.982	8	0.083

\* $p < 0.05$  statistical significance

Based on results in Table 2 in female judokas between levels there were significant difference in height ( $p = 0.022$ ), 1rm\_squat ( $p = 0.048$ ), and ab\_hold ( $p = 0.00$ ).

## Discussion

The aim of this study was to compare Chinese judo athletes from different levels (professional and amateur) further differentiating by gender. Several tests were used to evaluate anthropometrical characteristics and motor capabilities.

In the male comparison between levels, there was a statistically significant difference in terms of body mass (Weight) ( $p$ -value = 0.001) which can be explained by looking at biological age, with professional judokas being older, with established and fully matured endocrine systems resulting in accumulation of higher muscle mass compared to younger semi-professional counterparts. This has been shown in the previous study of Štefanovský et al. (2017).

Tests selected for assessing general strength levels including 1RM in Bench Press and Squat both showed to be significantly different ( $p$ -value = 0.000) with professional judo athletes showing higher strength levels compared to the amateur group. Similar findings can be found in the study of Drid et al. (2015). These results were partly expected knowing the fact that higher training age, maturation status, as well as more structured training programs, should all go in favor of the elite group of male judokas eventually leading to accumulating more training hours combined with larger volumes and higher intensities in practice.

Eventually, this leads to bigger and stronger bodies expressed through larger CSA (Lanza et al. 2022), better intra and intermuscular coordination as well as being able to move the bar with more intent than less experienced athletes.

Harris et al., (2020) also showed that higher level judokas who won medals and have higher achievement are more likely to be stronger than those who don't perform at a high level.

Professional male judokas also performed better in the 30-meter sprint test, while achieving faster times than the amateur ones ( $p$ -value = 0.003). To authors knowledge to date there is no study comparing speed performance in judokas from different levels and between genders mostly because sprint testing like the 30-meter sprint is rarely used in judo due to the sport's multifaceted demands, emphasizing skill, agility, and intermittent high-intensity efforts rather than straight-line speed.

Therefore knowing the fact that sprinting is a locomotive action which depends on the application of vertical and horizontal propulsive forces, it has been shown in the literature that those athletes who can apply higher forces on the ground will run faster (Weyand et al. 2000 and Cronin & Hansen 2005) which can partly fit the findings in the 1RM test such as squat and 1RM bench press. Still, judo athletes are not quite used to sprint training like athletes involved in team sports or track and field, which means results from this test should be interpreted with percussion.

In the isometric abdominal hold (ab\_hold) the professional group showed statistically different results than the amateur group ( $p$ -value = 0.000) with pros holding the test position for longer. These results can also be seen from a training age, and training program perspective, with professionals spending more time in practice, and having a more detailed approach in training.

Height, Isometric Pullup Hold using Judogi (pullup\_judogi\_iso), and Biering-Sorenson test (back\_hold), all showed non-significant differences between male groups,  $p = 0.378$ ,  $p = 0.058$ , and  $p = 0.911$  respectively.

The results in the Isometric Pullup Hold using Judogi go well with those previously published in the study of Franchini et al., 2011, while similar results in the Height and Biering-Sorenson test (back\_hold) cannot be related directly to particular factors.

When comparing the female groups, judokas from the professional team were found to be taller than the amateurs (p-value = 0.022).

Also, the professional group was significantly stronger in the 1RM Squat test (1rm\_squat) (p-value = 0.048) and endured longer in the isometric abdominal hold (ab\_hold) (p-value = 0.000).

The results in the 1RM Squat test are in harmony with the conclusion by Franchini et al., 2011 who noted that lower body dynamic strength can be seen as a way to distinct between elite and non-elite judo athletes. For the isometric abdominal hold, the interpretation of the results goes well with those previously explained for the comparison between the male groups.

Weight, 1RM bench press (1rm\_bench), 30-meter sprint (30m\_sprint), and Biering-Sorenson test (back\_hold) presented with no statistically significant different results in the female groups.

1RM bench press strength did not differ between professional and amateur female judokas and this can be partly viewed through the lower portion of lean muscle mass distributed in the female athletes which makes it harder to make substantial progression in strength in the upper body, which is not the case when it comes to the lower body (Miller et al. 1993).

Lastly, no difference between the amateur and professional female judokas in a 30-meter sprint can also be seen from the perspective of limited exposure to this type of action, as well as the limited number of participants in this study.

## Conclusion

In conclusion, this study aimed to analyze and compare judo athletes from professional and amateur levels according to gender.

The results showed that pro male judokas tend to be taller, faster, stronger, and have higher anterior core endurance capacities than the group of amateur judokas. This can be partly explained by factors such as maturation status, training age, and training history, but others such as physiological and morphological make-up, anthropometrics, and body composition should not be avoided. On the other hand, male groups did not differ significantly in height, upper body strength endurance, and posterior core endurance.

Female professional judokas were found to be taller and have higher lower body strength and higher anterior core endurance capacities than the judokas from the amateur group. However, there were no significant differences found in weight, speed, upper body strength and strength endurance, and posterior core endurance.

In essence, this study contributes valuable insights into the discernment of physical distinctions among elite and semi-professional male and female Chinese judokas. The findings furnish pertinent information with potential implications for refining training strategies and fostering the overall development of athletes engaged in this sport.

## REFERENCES

**Bonitch-Góngora, J., Almeida, F., Padial, P., Bonitch-Domínguez, J. G., & Feriche, B. (2013).** Maximal isometric handgrip strength and endurance differences between elite and non-elite young judo athletes. *Archives of Budo*, 9, 239–248.

**Branco, B., Diniz, E., Santos, J., Shiroma, S., & Franchini, E. (2017).** Normative tables for the dynamic and isometric judogi chin-up tests for judo athletes. *Sport Sciences for Health*, 13, 1–7. doi:10.1007/s11332-016-0331-8

**Cronin, J. B., & Hansen, K. T. (2005).** Strength and power predictors of sports speed. *J Strength Cond Res*, 19(2), 349–357. doi:10.1519/14323.1

**Drid, P., Casals, C., Mekic, A., Radjo, I., Stojanovic, M., & Ostojic, S. M. (2015).** Fitness and Anthropometric Profiles of International vs. National Judo Medalists in Half-Heavyweight Category. *J Strength Cond Res*, 29(8), 2115–2121. doi:10.1519/jsc.0000000000000861



- Franchini, E., Del Vecchio, F. B., Matsushigue, K. A., & Artioli, G. G. (2011).** Physiological profiles of elite judo athletes. *Sports Med*, 41(2), 147–166. doi:10.2165/11538580-000000000-00000
- Franchini, E., Miarka, B., Matheus, L., & Del Vecchio, F. (2011).** Endurance in judogi grip strength tests: Comparison between elite and non-elite judo players. *Archives of Budo*, 7.
- Harris, D., Kendall, K., Haff, G., & Latella, C. (2020).** Absolute and Relative Strength, Power and Physiological Characteristics of Indian Junior National-Level Judokas. *Sports*, 8, 14. doi:10.3390/sports8020014
- Julio, U. F., Panissa, V. L. G., Esteves, J. V., Cury, R. L., Agostinho, M. F., & Franchini, E. (2017).** Energy-System Contributions to Simulated Judo Matches. *Int J Sports Physiol Perform*, 12(5), 676-683. doi:10.1123/ijspp.2015-0750
- Lanza, M. B., Martins-Costa, H. C., De Souza, C. C., Lima, F. V., Diniz, R. C. R., & Chagas, M. H. (2022).** Muscle volume vs. anatomical cross-sectional area: Different muscle assessment does not affect the muscle size-strength relationship. *Journal of biomechanics*, 132, 110956. Retrieved from <https://www.sciencedirect.com/science/article/pii/S002192902200015X>. doi:<https://doi.org/10.1016/j.jbiomech.2022.110956>
- Lohman, T. G., Roche, A. F., & Martorell, R. (1988).** *Anthropometric Standardization Reference Manual: Human Kinetics Books.*
- Miller, A. E. J., MacDougall, J. D., Tarnopolsky, M. A., & Sale, D. G. (1993).** Gender differences in strength and muscle fiber characteristics. *European journal of applied physiology and occupational physiology*, 66(3), 254-262. Retrieved from <https://doi.org/10.1007/BF00235103>. doi:10.1007/BF00235103
- National, S., Conditioning, A., & Miller, T. (2012).** *NSCA's guide to tests and assessments* [1 online resource (viii, 359 pages): illustrations]. Retrieved from <http://public.eblib.com/choice/publicfullrecord.aspx?p=3011921>
- Ren, M., Tian, Y., McNeill, C., Lenetsky, S., & Uthoff, A. (2023).** The Role and Development of Strength for Elite Judo Athletes. *Strength and Conditioning Journal, Pub Ahead of Print*. doi:10.1519/SSC.0000000000000778
- Štefanovský, M., Kraček, S., Číž, I., & Czibulová, K. (2017).** Differences in morphological parameters of judo athletes of different age groups and performance levels. *Acta Gymnica*, 47(4), 187-192. Retrieved from <https://gymnica.upol.cz/artkey/gym-201704-0005.php>  
<http://dx.doi.org/10.5507/ag.2017.022>. doi:10.5507/ag.2017.022
- Weyand, P., Sternlight, D., Bellizzi, M., & Wright, S. (2000).** Faster top running speeds are achieved with greater ground forces not more rapid leg movements. *Journal of applied physiology (Bethesda, Md.: 1985)*, 89, 1991–1999. doi:10.1152/jappl.2000.89.5.1991
- Wood, R. (2008).** Abdominal Sit-Up Endurance Tests. Retrieved from <https://www.topendsports.com/testing/tests/abendur.htm>
- Yasul, Y., Akdemir, E., Öner, S., Anil, B., Korkmaz, E., Pekesen Kurtça, M., . . . Disabilities Editor, I. (2023).** The Effect of Core Training Practices on Some Strength, Lower Limb Functions and Balance Performance in Judo Athletes. *International Journal of Disabilities Sports & Health Sciences*, 6, 507–520. doi:10.33438/ijd-shs.1329696