

Explanatory and Statistical Analysis for Top-Level Kata Competitions in Karate-1 Events

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Abstract

This study analyzes the data of the top-level kata competitions in 15 Premiere League series and Series-A series during 2019 and 2020. In particular, the variety and frequency of katas performed by men and women in individual and team sections are reported. The results show that in the individual section, Suparinpei, Anan Dai, and Papuren are the most performed katas, while in the team section, the participants are more inclined towards Unsu, Kanku Sho, and Anan. Regarding gender, Papuren and Paiku have been the most frequent katas performed by women in individual and team sections, respectively, while the most preferred kata for men is Unsu in both sections. In addition, it turns out that in competitions for a medal, the pair of (Chinbana No Kushanku, Chatanyara Kushanku) and (Anan, Unsu) were on the top of performed katas in individual and team sections, respectively. Finally, the contribution of men and women to top countries in terms of average achieved points and number of attendance in the competitions are discussed

Keywords: Karate, Kata, Statistical analysis, Karate-one, Premiere League, Series A

1. Introduction

Karate is a martial art with Japanese roots that consists of three parts; kihon, kata, and kumite. Kihon embodies the basics of the martial arts movement; the committee fights one or more real opponents, while kata has a subtler and complex definition. Kata, which means "form" in Japanese, consists of a coherent and coordinated combination of martial arts movements performed alone or in groups to fight a hypothetical opponent. In fact, kata is the repository of karate movements, and the correct and accurate execution of the techniques is quite important, unlike the kumite.

Kata competitions are subject to special rules set by the World Karate Federation (WKF). These competitions, where participants and judges are required to wear specific karate clothes and uniforms, it is held in two sections, individual and team, and for men and women separately. The number of katas required for the performance is determined in proportion to the total number of participants, which can be up to 5 katas. While previously the competitions were conducted with five judges and with a flag system, from the beginning of 2019, the official kata competitions are evaluated with seven judges and with a scoring system. In the scoring system, after performing the kata, each referee records two separate points for the athlete in the range of 5 to 10 based on athletic performance and technical performance. The system then removes a maximum of two points and a

minimum of two points per performance and calculates the athlete's final score with an average weight of 0.7 for technical performance and 0.3 for athletic performance.

In official kata competitions, only kata is allowed from the official list of the WKF. It is necessary to explain that each kata has a special origin in terms of style (Goju-Ryu, Shotokan-Ryu, Wado-Ryu, and Shito-Ryu), so performing the same kata by two athletes may have slight differences according to the style. Currently, the official kata list of WKF includes 102 katas (World Karate Federation, 2019). For the first time, karate competitions are included in the 2020 Tokyo Olympic Games. For this reason, the popularity of karate by athletes has improved significantly in recent years. In particular, the official karate competitions have been met with great excitement and welcome. The change of evaluation system from a flag to a scoring system has also been in line with strengthening karate competitions at the Olympic level. Karate-1 Premiere League and Series-A are among the official tournaments which determine the WKF ranking of karate athletes.

There are only a few studies focusing on statistical analysis of kata competitions. (Augustovicova, *et al.*, 2018) reported frequency and successfulness of katas at eight Karate-1 (Premiere leagues, 2015; Novosad, *et al.*, 2020; Franchini, *et al.*, 2016) studied the performed katas at 2019 Karate-1 Premiere League. There are also some researches concerning physiological demands (Doria, *et*

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al., 2009; Vujkov, et al., 2015) and time-motion (Tabben, et al., 2015; Francine, et al., 2016) in the literature. The main motivation of the study is to statistically analyze the contribution of the performed katas at Karate-1 Premiere League and Series-A during 2019 and 2020. More specifically, we aim to investigate how men and women from different countries differ in terms of selected kata, the total achieved score, and how changing the evaluation system has affected the athletes' choices.

2.Methodology

2.1. Data

All the performed katas at fifteen WKF top-level karate competitions during years 2019 and 2020 are considered. These include seven consecutive Karate-1 Premiere League 2019 held in January (France, Paris), February (UAE, Dubai), April (Morocco, Rabat), June (China, Shanghai), September (Japan, Tokyo), October (Russia, Moscow), December (Spain, Madrid), three consecutive Karate-1 Premiere League 2020 held in January (France, Paris), February (UAE, Dubai), and February (Austria, Salzburg). It also includes four consecutive Karate-1 Series-A 2019 held in March (Austria, Salzburg), May (Turkey, Istanbul), June (Canada, Montreal), September (Chile, Santiago), and only Karate-1 Series-A 2020 held in January (Chile, Santiago).

2.2. Subjects

The collected data consists of 4592 records with 11 fields including athlete's name, nationality, performed kata, class (individual or team), gender, league (Premiere or Series-A), round, athletic point, technical point, and total point. In addition, we created two extra fields for records which competition is for the medal: the opponent's kata and the result of the competition. Herein, no athlete's name or any other personal data was reported to preserve anonymity.

An overall evaluation of the data revealed that 52.11% of the participants were male and 47.89% were female. It also turns out that 49.89% of the collected data are recorded for Premiere League and 50.1% are those of Series-A. In addition, 88.89% of the performed katas are in individual classes while 11.11% are related to team competitions. Another important subject is that 118 and 224 out of 4592 records are competitions for gold and bronze medals, respectively.

In individual classes, a total of 837 unique athletes from 95 different countries have participated where 37 out of 102 official katas have been performed. On the other hand, in team class 24 out of 102 official katas have been demonstrated. Regardless of gender and class, *Anan Dai*

has been the most performed kata followed by *Suparinpei* and *Papuren*. It is also worth mentioning that regardless of the individual/team class, 38 unique katas out of 102 official katas have been performed in the recorded data.

2.3. Tools

All the 4592 records of the performed katas were collected as an Excel spreadsheet. In this research, we utilized statistical packages of the Python program under the Windows environment for statistical analysis and drawing of explanatory plots. Furthermore, the Chi-square contingency test was utilized to discover statistically significant relationship between interested features.

3.Results and Discussion

In this section, we analyze, discuss and report the details of the findings from the recorded data. Analysis of the individual class data, regardless of gender, reveals that 8 katas make up more than 80% of the performed katas (Fig. 1). More specifically, it is clear from Fig. 1 that *Suparinpei*, *Anan Dai*, and *Papuren* are the most performed katas in the studied events, respectively. The same analysis on the team class reveals that *Unsu*, *Kanku Sho*, and *Anan* are on the top of the performed katas (Fig. 2). The interesting point is that there is no commonality between the top four katas of both team and individual classes.

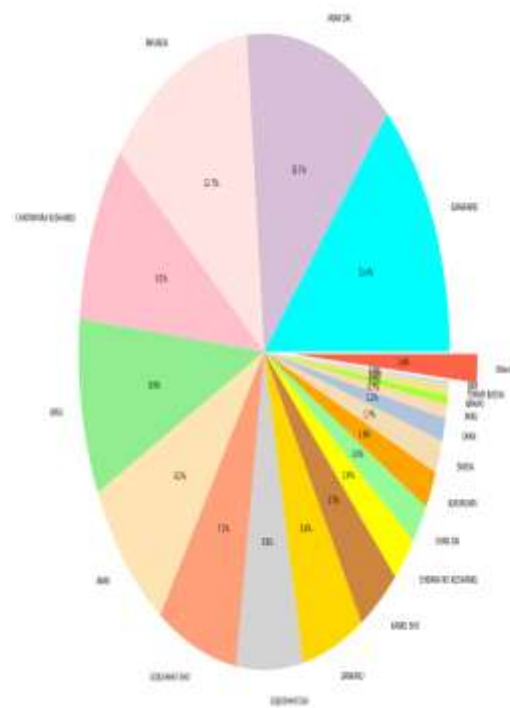


Fig.1. Frequency of the Performed Individual Katas (Men & Women)



Fig. 2. Frequency of the Performed Team Katas (Men & Women)

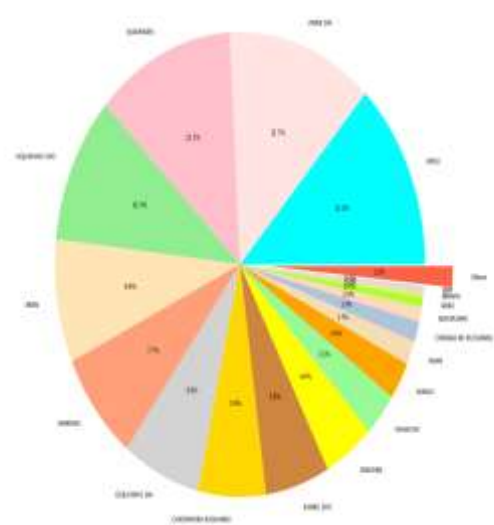


Fig. 4. Frequency of the Performed Individual Katas (Men)

Now, if we consider the gender of the athletes, we realize that there is a difference in the prioritization of men's and women's choices. Fig. 3 shows that women in individual classes perform *Papuren* (21.8%), *Suparinpei* (14.9%), and *Anan Dai* (13.4%) on the top, while men's preferences are *Unsu* (13.2%), *Anan Dai* (12.7%) and *Suparinpei* (12.1%) (Fig. 4).

A comparison of Fig. 3 and Fig. 4 shows that men take a higher risk in an individual class by choosing *Unsu* on the top than women who choose a more conservative kata like *Papuren*. This can be confirmed when we notice the change in 2nd and 3rd priority of *Anan Dai* and *Suparinpei* for men's and women's choices.

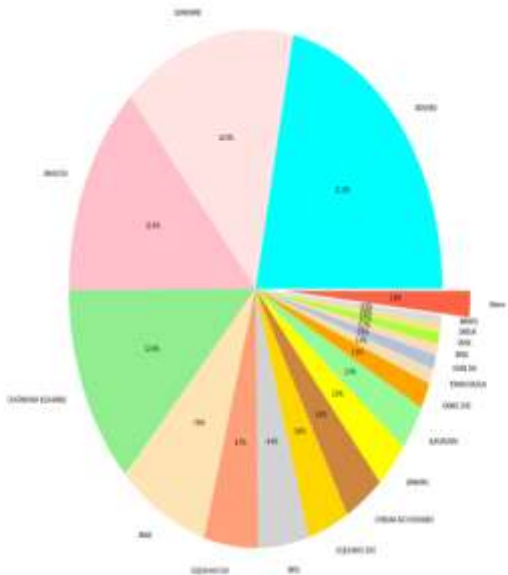


Fig. 3. Frequency of the Performed Individual Katas (Women)



Fig. 5. Frequency of the Performed Team Katas (Women)

In the team class, *Paiku* ranks the first for women's performance with a contribution of 17.7%, followed by *Anan* (14.3%) and *Anan Dai* (10.1%). *Papuren* which was ranked number one in the individual class, has dropped to sixth place in the team category (Fig. 5). On the other hand, the first place in the men's team kata similar to the individual class is held by *Unsu*. However, *Kanku Sho* and *Gojushiho Sho* occupied the next positions instead of *Anan Dai* and *Suparinpei* (Fig. 6).



Fig. 6. Frequency of the Performed Team Katas (Men)

A Chi-square contingency test with a significance level of 0.05 reveals that gender and performed individual katas are dependent with a p-value of 0.000524 (*reject H₀*). In addition, the test for team class again confirms the same result with a p-value of 4.942e-07.

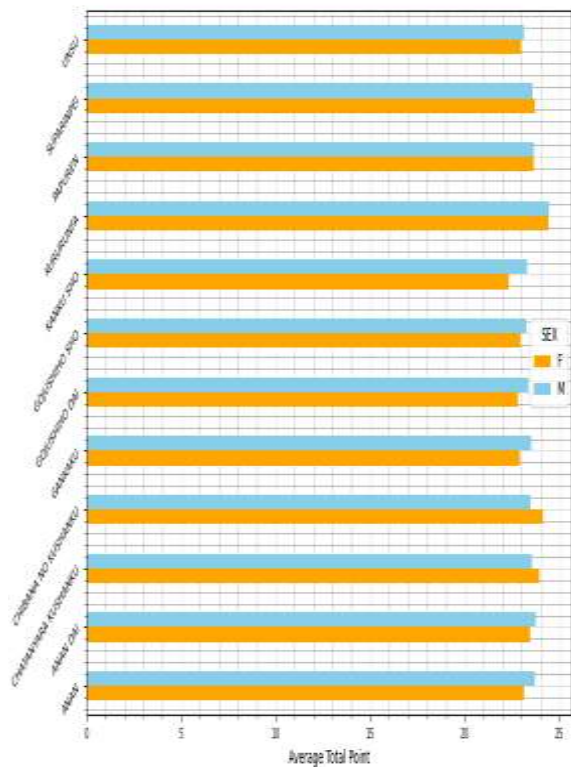


Fig. 7. Average total points in top 12 katas by gender

Fig. 7 demonstrates the average total score achieved by the karate athletes for 12 most frequently performed katas. In a glance, it can be observed that both men and women have gained the average highest score with *Kururunfa*. Another noteworthy observation is that women had the worst performance in *Kanku Sho* while *Gojushiho Sho* had the lowest average score for men. In addition, you may notice that relative superiority in *Unsu*, *Kanku Sho*, *Gojushiho Sho*, *Gojushiho Dai*, *Gankaku*, *Anan Dai*, and *Anan* is evident for men as well as relative superiority for women in *Chibana No Kushanku*, *Sparinpei*, and *Chatanyara Kushanku*. However, the difference in the average points earned in *Kururunfa* and *Papuren* is negligible.

The contribution of the performed katas in the individual and the team matches for medals is depicted in Fig. 8 and Fig. 9, respectively. From Fig. 8, it is clear that in 11% of the individual competitions that lead to medal acquisition, the competition was the pair of (*Chibana No Kushanku*, *Chatanyara Kushanku*) followed by (*Chatanyara Kushanku*, *Chatanyara Kushanku*) and (*Chatanyara Kushanku*, *Ohan Dai*). It is particularly interesting that in more than half of the final and semi-final competitions *Chatanyara Kushanku* has been on one side of the competition.

On the other hand, in the team class, it is clear from Fig. 9 that the combination of final and semi-final katas is completely different from the individual class. More specifically, in 16.2% of the team competitions that lead to medal acquisition, the competition was the pair of (*Anan*, *Unsu*) followed by (*Unsu*, *Unsu*) and (*Anan*, *Anan*). In this category, each of the *Anan* and *Unsu* is performed in at least 40% of the final and semi-final competitions.

Due to the fact that the distinction between the performed katas to win a medal in both teams and individual classes is quite clear, so the dependency between the competition class and the performed kata are accepted without the need for a statistical test.

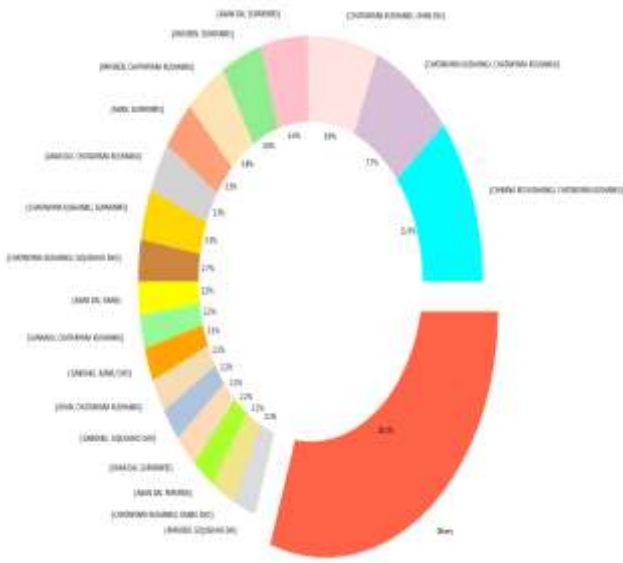


Fig. 8. Contribution of katas in individual matches for medal

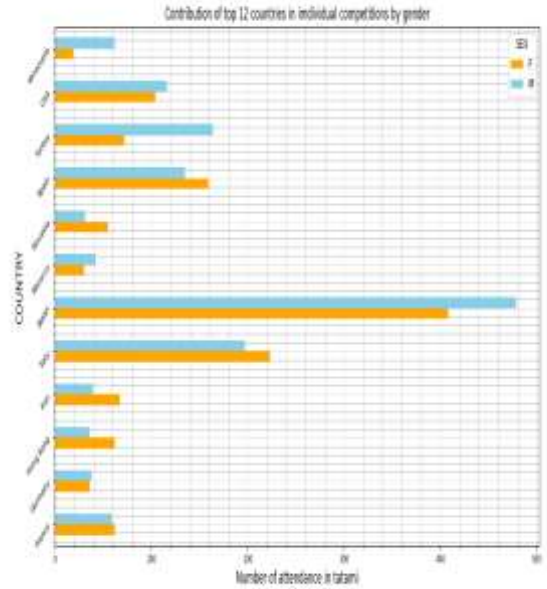


Fig. 10. Number of attendance in tatami for top 12 countries in individual competitions by gender

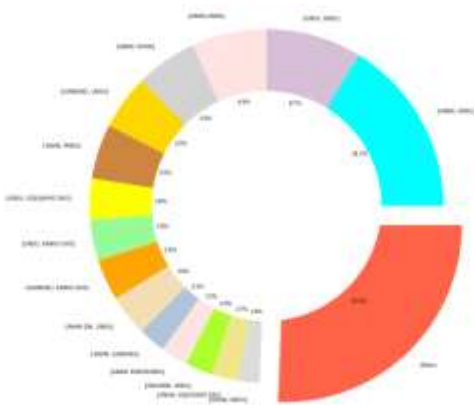


Fig. 9. Contribution of katas in team matches for medal

The share of different countries in professional kata competitions is not balanced. Fig. 10 shows the number of attendance in the top-ranked kata competition for the top 12 countries in an individual class. As expected, Japanese athletes are ranked first in the professional kata competition with a record of 887 attendance followed by Italy (420), Spain (294), Turkey (236), and the United States of America (220). From Fig. 10 you may notice that in Japan, Turkey, the USA, Venezuela, Germany, and Morocco, the number of female professional participants is more than men, while in Italy, Spain, France, Iran, Hong Kong, and Slovakia, it is the opposite.

Fig. 11 shows the average total score in the top 12 countries in the individual class grouped by gender. It is again clear that Japanese athletes are ranked first in the professional kata competition in terms of the average total score. Interestingly, in 8 out of 12 countries women have gained more points than men. Venezuelan male athletes scored significantly more points than their compatriot women, while the opposite is true for Hong Kong.

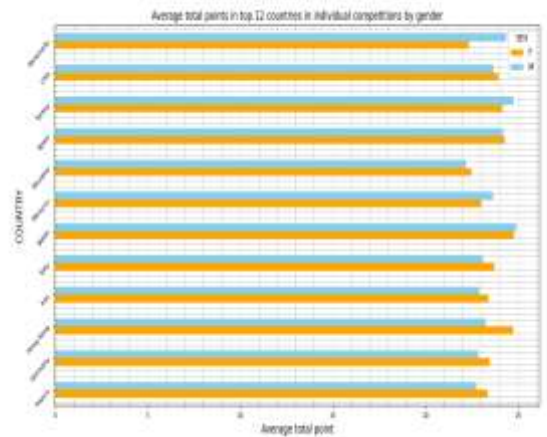


Fig. 11. Average total points for top 12 countries in individual competitions by gender

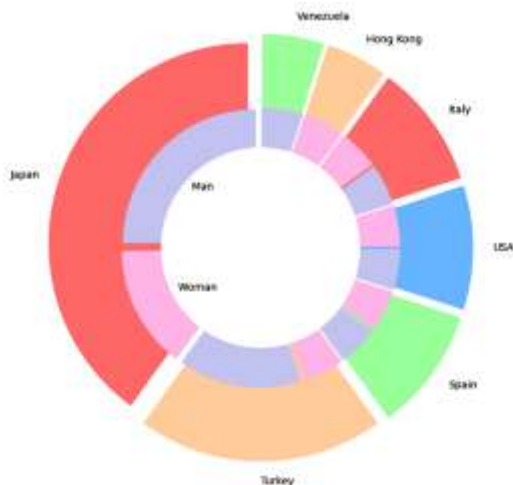


Fig. 12. Contribution in individual competitions for top 20 athletes by country and gender

Herein, we sorted the athletes in terms of the number of their attendance in the studied high-ranked karate events. It turned out that 8 out of 20 athletes were from Japan including 5 men and 3 women. In addition, six other countries contributed to this list (Fig. 12). As it can be found in Fig. 12, Turkey, Spain, the USA, and Italy have both male and female representatives in the top 20 list, while Hong Kong and Venezuela have only female and male representatives, respectively.

4. Conclusion and Summary

The most performed katas were *Anan Dai* followed by *Suparinpei* and *Papuren*, regardless of gender and class. In the individual category, 837 unique athletes from 95 countries participated where 37 out of 102 official katas performed. In this category *Suparinpei*, *Anan Dai*, and *Papuren* were the most performed katas. In the team category, *Unsu*, *Kanku Sho*, and *Anan* were on the top of the performed katas. There was a significant statistical relationship between gender and choice of katas in both individual and team categories. Women athletes in the individual class perform *Papuren* (21.8%), *Suparinpei* (14.9%), and *Anan Dai* (13.4%), while men prefer *Unsu* (13.2%), *Anan Dai* (12.7%) and *Suparinpei* (12.1%). Women athletes in team kata preferred *Paiku* (17.7%), *Anan* (14.3%), and *Anan Dai* (10.1%), while men prefer *Unsu* (21.6%), *Kanku Sho* (20.1%), and *Gojushiho Sho* (16.5%). Both men and women gained the average highest score with *Kururunfa*. Women had the worst score with *Kanku Sho* while *Gojushiho Sho* had the lowest average outcome for men. The pair of (*Chibana No Kushanku*, *Chatanyara Kushanku*) was on top of the performed kata competitions that lead to model acquisition. These figures are different from those of

Augustovicova *et al.* (2018) which can be attributed to changing the evaluation from a flag to a scoring system. Japanese athletes are ranked first in professional kata competitions in terms of the average total score, the number of attendance in the events, and their contribution to the top-athletes list. The findings of this study can help karate coaches and sports managers to have an effective plan for their athletes.

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