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Statistical Analysis of the Technical Performance Characteristics for Li Na in 2013 Australian Open

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Abstract: This study the actual data of Li Na in the 2013 Australian Open, conducts statistical analysis on Li's overall performance in through Excel, SPSS software and concretely analyzes the net, serve and other specific links. The results show that: in the comprehensive statistical analysis of the data it is difficult to find the obvious advantage of Li Na and opponents in the technical performance; while in unilateral analysis of Li Na and opponents, we found that Li Na's success in the game depends largely on her serve, in the side of breaking a serve, Li Na's serve break is 64 which is significantly higher than the opponent's 42. In addition, Li Na's ball handling on the net in this competition is very good, whether it is the line pre-judgment of the crossing ball on the net or on the control of placement of the opponent's batting ball, the performance is very good.

Key words: Australian open, Li Na, technical characteristics, statistical analysis

INTRODUCTION

The most talked about tennis tournament is four Grand Slam tennis tournament held annually, the four Grand Slam tennis stands for professional tennis's highest honor. Li Na hits from tennis low-level competition to four Grand Slam tournaments, is the first to get the Tour singles title of the Chinese people and is the fourth in the 2008 Beijing Olympic Games (Gu, 2013). In 2011 she won the French Open women's singles championship, became the first person to win singles champion of the four Grand Slam tennis in China and Asia, the world ranking reached No. 4 and she tied the Asia's highest ranking in women's tennis created by Japanese player Kimiko Date (Deng, 2008). January 29, 2011, in the much-anticipated Australian Open women's singles final, tournament No. 9 seed, Li Na golden flower of China met head-on Kim Clijsters the tournament No. 3 seed, three U.S. Open champion (Zhang, 2010). After 124 min hard work, Li was finally reversed by rivals, missing the Australian Open championship; But runner-up has created the best record of Chinese players' history in Grand Slam singles tournament (Xing *et al*., 2006). Li Na's tremendous achievements in tennis made her receive widespread attention at home and abroad, many people began to analyze and study the relevant data to her race (Chen *et al*., 2004).

By technical statistical analysis of Li Na in 2011 Australian Open singles match, Zhou (2011) found that women's tennis technology develops androsphinx it is very difficult to win the game relying solely on the opponent's initiative errors and players must take the initiative in the game to improve their ability to score which is key factor to win a contest (Cui, 2013). Tai Jian Feng's statistics and analysis of Li Na's techniques and tactics in 2013 Australian tennis tournament, the results showed that: in today's tennis tournament the level of psychological resilience and the length of time focused around become an important factor in winning a competition (Zhang, 2013).

This study uses Excel, SPSS software to conduct a statistical analysis on the data of Li Na in the 2013 Australian Open (www.australianopen.com), finds out the pros and cons of various tactics of Li Na in the game, make some recommendations and aims at providing some reference for the development of Chinese women's tennis.

COMPREHENSIVE ANALYSIS OF LI NA'S COMPETITION DATA

Table 1 shows the statistics data of Li Na and opponents of seven rounds at the Australian Open (www.australianopen.com). The data items in the table relates to the key factors that determine the winner in the tennis match, such as ACE ball, double fault, etc.

Table 2 gives the comparison of Li Na and opponent in ACE ball and first serve success.

By comprehensive analysis of data in Table 1 and Table 2, according to the data obtain the comprehensive comparison Fig. 1 of Li Na and opponent's competition data. We can see from Fig. 1: The gap with rivals of Li Na in the serve point, average first serve speed and average 2nd serve speed, she is superior to opponent in aspects of the net scoring rate and first serve scoring rate. In

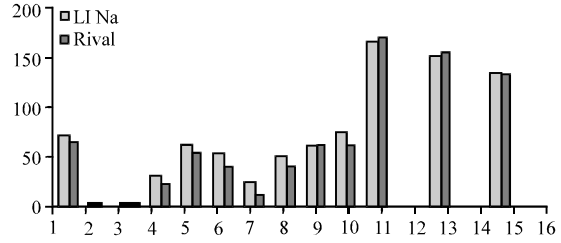

Fig. 1: Comprehensive comparison of Li Na and opponents' competition data

Table 1: Li Na and opponent's data statistics in Australian open

Data items	Li Na	Opponents of seven rounds
First serve success rate	71%	67%
ACE ball	1.7	0.9
Double fault	1.7	2.7
Unforced errors	31	23
First serve scoring rate	63%	54%
Second serve scoring rate	53%	40%
Winning points	25	12
Return of service wiuning points	52%	41%
Net scoring rate	64%	63%
Total points	75	62
Fastest serve speed	166km h^{-1}	170 km h^{-1}
Average 1st serve speed	152 km h^{-1}	153 km h^{-1}
Average 2nd Serve Speed	133 km h^{-1}	132 km h^{-1}

Table 2: Comparison of Li Na and opponents in the ACE ball and first serve success rate

Statistics item	Li Na	Opponent
ACE ball	170%	90%
First serve success rate	1.7	2.7
Relative gap	47%	58%

aspect of ACE ball, first serve success rate she still has a relatively large gap with the opponent (Wang and Shuye, 2013).

In mathematics, the definition of the relative gap is similar to the relative error, namely:

$$\eta = \frac{X_i - X_j}{X_i} \times 100\%$$

It is commonly used to indicate the gap between the two numbers.

Substitute the data in Table 1 into SPSS software for statistical analysis and obtain the following Table 3.

As can be seen in Table 3, Mean (mean) is respectively 68 and 63%. It represents the arithmetic mean which is the index reflects the central tendency or the average of all values □□ of a variable. The equation is:

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

Numerically it is not difficult to find that the mean of the two are very similar, so we continue to examine the differences between the two standard deviations, as shown in Table 4.

In Table 4, the sample standard deviation (Standard Deviation: Std Dev) is, respectively 52.8 and 55.6%, the sample standard deviation is the statistics of the average dispersion degree from the variable to the mean value. It is also known as the MSE (mean square error), the square root of the sum of squared deviations, indicated by σ. Standard deviation is the arithmetic square root of the variance. Standard deviation can reflect the dispersion degree of a data set (Tan, 2013). The mean values are same and the standard deviations are not necessarily the same. The equation is:

$$S = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2}$$

As can be seen from Table 4, the standard deviation of Li Na and the rivals is also approximately the same. This suggests that on the whole, the dispersion degree between them is not large.

From the correlation degree of the paired samples in Table 5, the correlation coefficient of Li Na and seven rounds' opponent reaches 0.995. In mathematical statistics, correlation coefficients, or linear correlation coefficient, the Pearson product-moment correlation coefficient, etc., is an indicator to measure the linear correlation degree between two random variables. It is put forward by Carl • Pearson (Karl Pearson) □□ in the 1880 sec and has been widely used in various fields of science. The calculation formula of correlation coefficient is:

$$r_{XY} = \frac{\sum_{i=1}^{N}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{N}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{N}(Y_i - \overline{Y})^2}}$$

The correlation coefficient ranges [-1, 1], r>0 means a positive correlation, r<0 indicates a negative correlation, |r| represents the correlation degree between the variables. Usually when |r| is greater than 0.8, the two variables have a strong linear correlation. As in Table 5, the correlation coefficient r of Li Na and opponents reaches 0.995, indicating Li Na and opponent has a high correlation with each other during the game (Yang, 2013).

The mean of value Sig is significant; it means that the odds of the average value in a few percent are equal. Usually this value Sig is compared with 0.05, if it is greater than 0.05, the probability of the average value more than 5% is equal and the probability less than 95% is not equal (Zhou, 2011). We believe that the probability of the equal average is relatively large, indicating that the difference is

Table 3: Depiction of the data

	Descriptive statistics				
	N	Minimum (%)	Maximum (%)	Mean (%)	Std. Deviation (%)	Variance
Li Na	13	1.70	166.00	68.3385	52.81484	2789.408
Opponents of seven rounds	13	0.90	170.00	63.1231	55.61347	3092.859
Valid N (list-wise)	13					

Table 4: Paired sample statistics

	Paired samples statistics			
	Mean (%)	N	Std. Deviation (%)	Std. Error Mean (%)
Pair 1				
Li Na	68.3385	13	52.81484	14.64820
Opponents of seven rounds	63.1231	13	55.61347	15.42440

Table 5: Correlation degree of the paired samples

	Paired samples correlations			
		N	Correlation	Sig.
Pair 1	Li Na and opponents of seven rounds	13	0.995	0

Table 6: Paired samples test

		Paired samples test							
		Paired Differences							
					95% Confidence interval of the difference				
		Mean (%)	Std. Deviation (%)	Mean Std. Error (%)	Upper (%)	Lower (%)	t	df	Sig. (2-tailed)
Pair 1	Li Na and opponents of seven rounds	5.21538	6.16466	1.70977	1.49012	8.94065	3.050	12	0.010

not significant, so that the mean value between the two sets of data are equal. If it is less than 0.05, the probability of the average value less than 5% is equal and the probability more than 95% is not equal. We believe that the probability of the equal average value is relatively small, indicating that the difference is significant, so that the average value between the two sets of data are not equal. In Table 5, the value Sig is 0, indicating that significance level between Li Na and her rival is significantly different (Liu, 2013).

It can be seen the test for paired samples From Table 6, the confidence level is selected as 0.05, confidence interval is 8.94% on the upper side and lower side of the confidence interval is 1.49%.

The confidence interval is the possible range of the overall parameters. 95% confidence interval means the possibilities of the overall parameters in this range is about 95%, or that the population parameter is in this range but its credibility is only 95 percent. When the sample is of the same amount, the higher the confidence level (95%) is, the wider the confidence interval is.

It is obvious Sig that the standard error of the mean value is 1.71%. Standard error of the mean value is the statistics to describe the overall mean difference between the mean average of these samples and the overall mean level. The sample mean is the average of η samples, partially eliminate the in homogeneity of the sample and reduces errors caused by accidental errors. Therefore, this sample mean value is □□ closer to the population mean more than individual sample values. So we have to use the mean of this group sample to estimate the overall mean. Sample mean also have errors, the greater the number of samples is, the smaller the error of the mean value is (Fan, 2013).

INDIVIDUAL ANALYSIS OF LI NA'S COMPETITION DATA

It is difficult to find specific aspects that can be improved by only analyzing Li Na's comprehensive data, so this section conducts unilateral analysis on Li Na and opponents' data.

Statistical analysis of serve technique: Serve is not only the start of scores in the tennis game but also the beginning of the attack it is the only technique that does not receive constraints and limitations in tennis technology. Good serve, not only can score directly but also can play the characteristics of the individual on a large extent, control each other and display their tactical intentions farthest (Zhang and Wang, 2008).

As can be seen from Fig. 2, the averaging Ace ball of Li Na is 1.7; it is significantly higher than other opponents' averaged 0.9. From Fig. 3, in terms of first

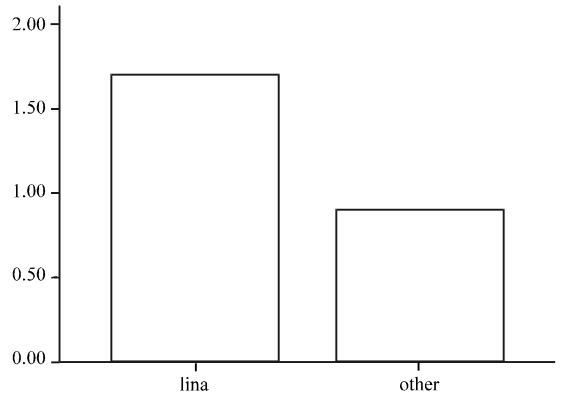

Fig. 2: Comparison of Li Na and opponents in Ace ball

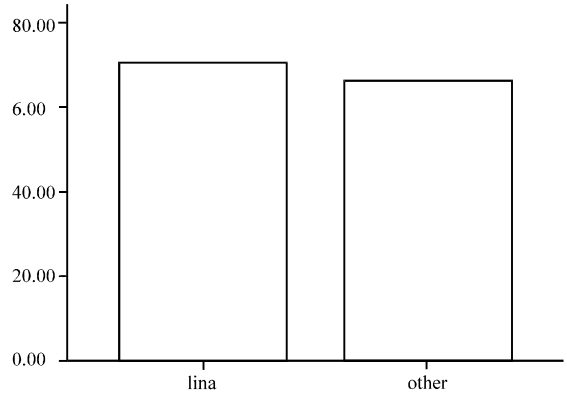

Fig. 3: Comparison of Li Na and opponents in first serve success rate

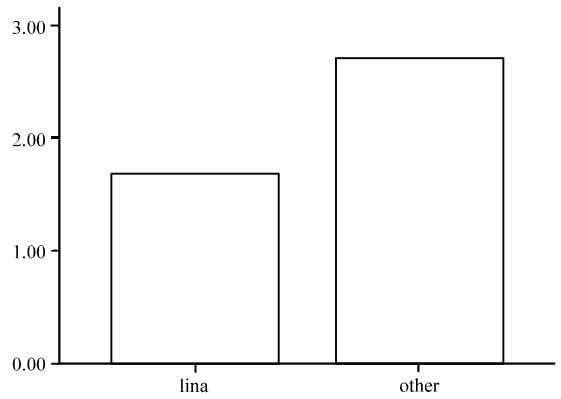

Fig. 4: Comparison of Li Na and opponents in double fault serve scoring rate we can see that: Li Na's first serve scoring rate is 71% while her opponents' first serve scoring rate is 67% and Li Na is slightly stronger than her opponents in the first serve scoring rate. In aspect of double faults it is evident from Fig. 4: The averaging double fault of Li Na is 1.7 while her opponent's averaging double fault is 2.7.

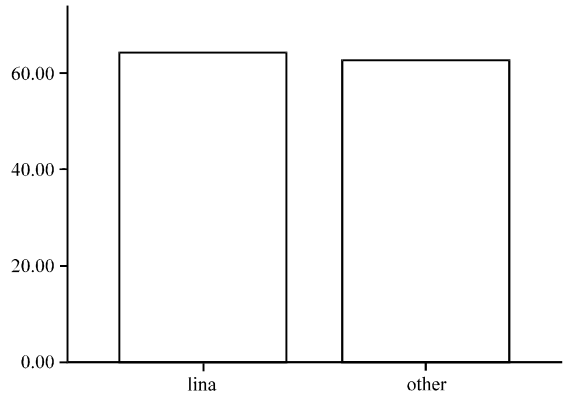

Fig. 5 : Comparison of Li Na and opponents before the net

Through the above analysis, we can know: Li Na's success in the game depends largely on her serve. She has a good strength in serve technique and plays relatively stable in the game but the advantages to the opponent is not obvious and it should be strengthened in the future.

Statistical analysis of Net score: Net score can not only show players' individual skills but also allows enhance players' self-confidence and thus to create certain psychological pressure to opposite side which is one of the very important technologies in the game. Seen from Fig. 5, Li Na's net score matches with opponents, even better than the opponents. Net scoring rate in the game is very high. The ball handling before the net at the Australian Open on is very good. Whether it is the line pre-judgment of the crossing ball on the net of the opponent or on the control of the placement of the batting ball, Li's performance is very good which worth studying by other players in China.

Statistical analysis of the return of service technique: The level of return of service technique is the primary sign of the balancing of offensive and defensive. For a tennis player, the score about half in the game is from the return of service. Therefore, whether the return of serve technique is good or bad is a major reason for the victory of the game.

As can be seen from Fig. 6 and 7 return of service scoring rate of Li Na is significantly higher than the opponents (52>41%). In the unforced turnovers: Li Na's averaged number 31 and her opponent is 23. It indicates that Li Na's return of serve capability and serve break success rate is much better compared with her opponents. Li Na is an offensive player, so she has a relatively strong strength the return of service, her return of service

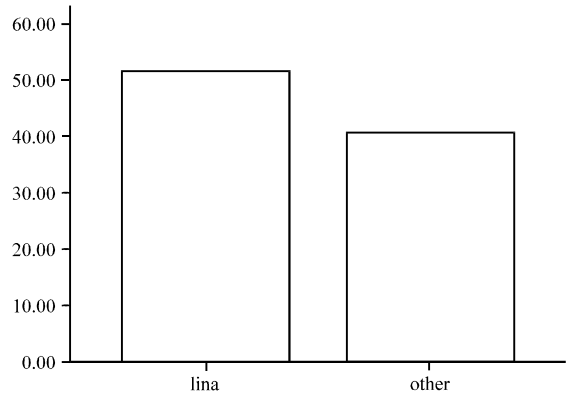

Fig. 6: Comparison of Li Na and opponents in unforced errors

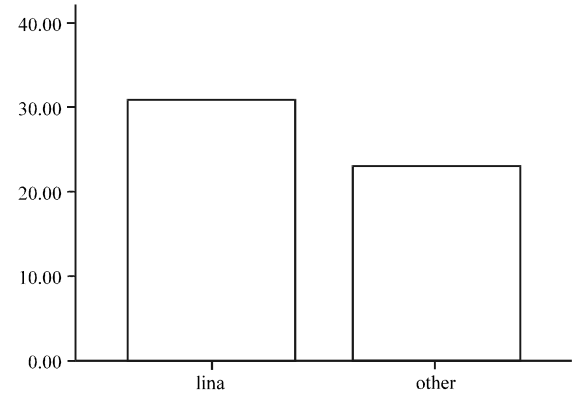

Fig. 7: Comparison of Li Na and opponents in return of service winning points

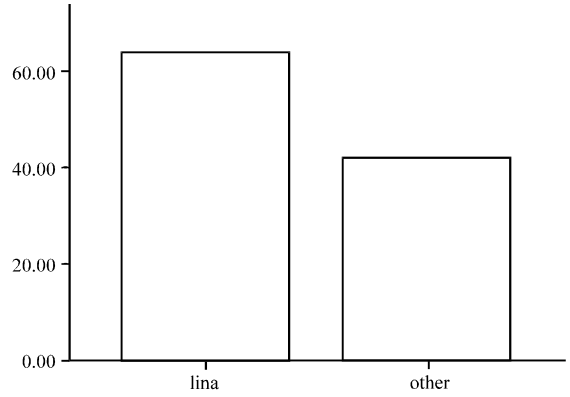

Fig. 8: Comparison of Li Na and opponents in breaking a serve

scoring rate and serve break success rate are significantly higher than her opponents. Clearly, good return of service technique is an important factor to win the game for Li Na. Break, also known as breaking serve, means making □□ a game victory in the face of the opponent's serve and generally break is one of the keys to win tennis matches. Tennis is a game that players exchange serve game at the start of a game. Thus, in tennis, in order to win the game, one must and can only break the opponent's serve in the opponent's serve. If in every game, players can only keep his serve, then it is impossible to win the game. Therefore, to break the opponent's serve is very important. As can be seen from Fig. 8, Li Na's break serve is 64 which is significantly higher than her opponent's 42.

CONCLUSION

As tennis technology continues to progress, women's tennis technology develops androsphinx it is very difficult to win the game relying solely on the opponent's initiative errors and players must take the initiative in the game to improve their ability to score which is the key factor to win a contest. Through the analysis in this paper we can know that: Li Na's success in the game depends largely on her serve. She has a good strength in serve technique and plays relatively stable in the game but in the year's Australian Open tennis tournament the advantages to the opponent is not obvious. Li's net score is matched with opponents, even better than the opponents. Net scoring rate in the game is very high. Her handling the ball on the net in the Australian Open tennis tournament is very good which worth studying by China's other players. So in the future training and competition Li Na must take the initiative to reduce her mistakes, continue to strengthen her psychological quality, so as to have a stable play in the game and win games.

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