Book of abstracts

of

The 15th ITTF Sports Science Congress

Düsseldorf, 27th – 28th May 2017


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Message from International Table Tennis Federation

ITTF President's Message

As a prelude to the individual World Table Tennis Championships it has become a tradition to hold a gathering of sport scientists interested in table tennis. This time Düsseldorf has an honour to host sports scientists from all over the world.

I urge sport scientists and researchers to look for the future, to anticipate trends, to provide us with a glimpse of what could be and what should be our sport in years to come, to help us leap forward based on scientific principles. The ITTF counts on you to guide the way to a healthy and safe future for our sport while maintaining the athletic and technical performance of our athletes. I also ask you to work closely with the coaches and the players to develop future trends that would enhance our beloved sport.

Important role by the learning procedure and technique analysis in modern approach has exchange of knowledge and data. Table tennis is one of the most popular sports in the world and we need to strengthen our role also in scientific researches around the world. This gathering of 100 table tennis scientists from all around the world is a proof that we have strong scientific background and we can count in the future on important results which will help table tennis to develop in appropriate way.

On behalf of the ITTF, I welcome you all to the 15th ITTF Sport Science Congress on 27th - 28th May and I hope that the more than 100 abstracts submitted by contributors from 25 states and 4 continents will ensure an interesting debate and be thought-provoking for all the participants.

I am very grateful to the organizers of this event, the 55th WTTC Organization Committee, Technical University Munich, German Table Tennis Association and members of the ITTF Sports Science and Medical Committee. I hope you enjoy the Congress and make new friends while renewing old ones. I also invite you after the congress to watch exciting matches at the 55th World Table Tennis Championships in the beautiful city of Düsseldorf.

Thomas Weikert
President ITTF

Message from Organizing Committee

Organizing Committee Chairman's Message

When being asked to become Organizing Committee chairman of the 15th ITTF Sports Science Congress as part of the 54th World Table Tennis Championships 2017 taking place in Düsseldorf, Germany, it didn't take a minute to arrive at a decision. It is a great honour for the Technical University of Munich and our department of Training Science and Sport Informatics to offer our expertise. Since we are active researchers in table tennis, mainly in performance analysis, this meets our organizational experiences as well as our research interests.

Research in table tennis is particularly interesting because of its interdisciplinary nature as well as of its combination of applied and basic science. Without bringing together the different disciplines of sports sciences and other scientific disciplines one cannot satisfy the demands of scientific research in a complex sport like table tennis. Moreover, the challenge is also, to build a bridge between basic research giving us a deepened understanding of phenomena in table tennis, and applied research dedicated to improve everyday practical work of players and coaches. Both aspects are met in an excellent manner by the conception of the congress as well as by the submitted papers what was registered with delight.

The Organizing Committee was overwhelmed by the outstanding resonance of the congress. There was a great amount of abstracts submitted by scientists of a great amount of countries from all over the world. On one hand this may be associated with the unique position of table tennis being distributed over the world in numbers of countries and players hardly found in any other sport. On the other hand this resonance demonstrates that there is an increasing interest of sports scientists all over the world to dedicate their work to table tennis. The most important function of this congress is to provide a platform for communication and exchange of scientific findings in table tennis, thus promoting these current trends.

Finally, it remains to the Organizing Committee to welcome all our international guests at Düsseldorf, Germany. We wish good talks, making new friends and maybe even starting new projects in the exciting field of table tennis. As chairman, I thank ITTF and DTTB for giving the opportunity to organize the congress and all members of the Organizing and Scientific Committee for the excellent support experienced.

Prof. Dr. Martin Lames
Organizing Committee Chairman

Contents

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OVTCHAROV AGAINST THE BIG FOUR – AN ANALYSIS OF THE PLAYING STYLE OF EUROPE´S NUMBER ONE IN TABLE TENNIS: RESULTS OF THREE-PHASE DIAGNOSTICS

Abstract

Prior to the Olympic Games of Rio de Janeiro, Germany´s ranked number five player in the world (as of July 2016), Dimitrij Ovtcharov, underlined his claim to challenge the Chinese competitors. In considering this proposition, an analysis using the three-phase method of performance diagnosis was done in regard to 18 matches against the four players ranked ahead of the German in the ITTF world ranking list. Taken on the whole, the results show that the playing strength of Fan Zhendong, Ma Long, Xu Xin and Zhang Jike is very much superior to the performance of Dimtrij Ovtcharov. But this does not mean that the German did not win any matches or that he was not able to keep up with his opponents in some situations, or stages of the rallies. For Dimitrij Ovtcharov, the chance to win is not tremendously but comparatively high when encountering Zhang Jike. A decent serve-and-return play seems to be required, based either on an excellent serving or a superb receiving behavior. In addition, for both players, the behavior in stalemate situations (after ball contact number four) seems to have a marked influence on their total match outcomes. In his matches against Zhang, Fan, and Xu, the German usually shows an acceptable or even good serving behavior. On the basis of the quality work already done in this respect, the receiving behavior of Dimitrij Ovtcharov probably has the strongest impact on his competition performance against the world´s very best players.

Key words: *systematic match analysis, three-phase evaluation, tactics*

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LEADERSHIP BEHAVIOUR AND SATISFACTION IN YOUNG TABLE TENNIS PLAYERS

Abstract

The main purpose of this study was to examine the relationship between the perceived and preferred leadership behaviour of young table tennis players and their satisfaction and secondly to investigate possible differences related to gender, competition league and years of practice. The sample consisted of 162 table tennis players (103 boys and 59 girls) from Athens and Northern Greece with a mean age 15.3 ± 1.52. Data was collected through Leadership Scale for Sports, in its two versions (perceived and preferred of athletes) and the Athlete's Satisfaction Scale. The statistical methods included reliability analysis, correlation analysis, t-test and one-way analysis of variance. The results indicated that the most perceived and preferred leadership behaviours were *training and instructions* and *positive feedback* and the least was *autographic behaviour*. Further results showed that, athletes' satisfaction had significant correlation with all four leadership behaviour dimensions in the perceived and the preferred version, while the *autographic behaviour* had a significant negative effect on the player's satisfaction. Additionally, the girls seem to feel more satisfied than boys with the leadership behaviour of their coaches while competition league and years of practice didn't influence the satisfaction the players felt from both Leadership and personal outcome.

Key words: *perceived and preferred leadership behaviour, satisfaction, young table tennis players*

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THE ROLE OF PSYCHOLOGICAL FACTORS IN TALENT DEVELOPMENT AMONG YOUTH TABLE-TENNIS PLAYERS INVOLVED IN INTENSIVE TRAINING PROGRAMS

Abstract

In order to support youth athletes to succeed at world-class level, national table-tennis (TT) associations use talent development programs to early identify high potential youth players. The present study focused on the psychological dimension highlighted by TT coaches to help youth French TT players in intensive training centers to develop into elite players. We explored if theoretically-relevant psychological variables (sport motivation, coping, athlete burnout, perceived stress and recovery) experienced by 159 youth TT players (M_age = 14.07, SD = 2.13) while they were in training centers (Time 1, T1) were related to their performance levels and playing status (continued participation versus dropout) six years later (Time 2, T2).

Results of ANCOVAs revealed that: (a) players who still practiced at T2 reported lower T1 amotivation, disengagement-oriented coping, sport devaluation and reduced accomplishment than the players who dropped out; (b) international and/or national players at T2 reported significantly lower T1 amotivation, disengagement-oriented coping and sport devaluation in comparison to regional TT players. Results of correlational analyses indicated that T2 performance and/or six-year performance progress were significantly negatively correlated with introjected and external regulations, amotivation, disengagement-oriented coping, sport devaluation, reduced accomplishment and perceived stress, and significantly positively correlated with perceived recovery.

In sum, despite the lack of monitoring over the 6 years between T1 and T2, results showed some psychological variables as essential factors for predicting future dropout and performance. These psychological variables could be completed with a multidimensional approach including anthropometric, motor-skill, or physiological to early identify high potential youth TT players.

Key words: *table tennis, talent development, performance, dropout, motivation*

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MODIFIED TABLE TENNIS FOR A VISUALLY IMPAIRED MALE COLLEGE STUDENT: A CASE STUDY

Abstract

We modified the sport of table tennis utilizing some showdown rules to suit the needs of a born visually impaired male college student enrolled in a 2 hours a week Adapted Physical Education class. In the study, the student was tasked to strike the table tennis ball in three different angles (middle to pocket, right side to pocket and left side to pocket). Modifications were made in the table tennis balls by inserting mung beans through a tiny incision in each ball to enable the visually impaired student to hear the ball. Pre-test results showed that the student struck the ball with 60% accuracy in the middle to pocket test, 17% in the right side to pocket test and only 5% in the left side to pocket test. A post-test was conducted after 12 meetings of non-continuous intervention that included playing games. A significant improvement was recorded, as the student was able to hit 73% in the middle to pocket test, 43% in the right to pocket post-test and 51% in the left side to pocket post-test.

Key words: *adapted physical education, visually impaired*

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MENTAL ABILITY DIFFERENCES IN TABLE TENNIS PLAYERS DEPENDING ON AGE

Abstract

The objective of this research was to find out if there is a difference in the mental ability of table tennis athletes depending on the age category (senior and veterans, and young table tennis players from 8 to 22 years old). The sample consisted of 133 table tennis players from around Spain. In order to measure the psychological abilities of table tennis athletes, the Spanish version of the "*Psychological Characteristics Related to Sport Performance Questionnaire*" (CPRD) was used. The results showed higher levels of motivation (p<.01) and mental ability (p<.01) in young table tennis players. No differences were found in the other factors (stress control, influence of performance evaluation and team cohesion). Subsequently, the mental ability factors were separated, the results showed higher levels in young table tennis players in: visualization practice (p<.01), positive self-talk (p<.05) and others mental abilities (p<.05). In the other areas (goal setting, objective performance analysis, skill deficit and stress control), no significant differences were found. In addition, linear regression analyses (R^2=.83) showed a relationship between the other mental abilities and young table tennis players. It was concluded that young table tennis players have better mental abilities in the areas of: visualization practice, positive self-talk, and other mental abilities. Furthermore, other mental abilities relate to young table tennis players.

Key words: *mental ability, racket sport, competition, psychological skills*

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STUDY FOR THE POSSIBILITIES AND HURDLES ENCOUNTERED WITH COACHING ONE JUNIOR AND/OR YOUTH PLAYER SWITCHING STYLES FROM CLASSICAL SHAKE HAND STYLE TO NEW “MG-SHIP” STYLE

Abstract

The enrichment of table tennis sport technical playing/coaching skills with an innovative, exclusively new, 3rd style named “The MG- Ship” style, confronting existing classical styles: Shake hand and Pen hold, was first recognised by the ITTF’s president database for new ideas, known as dbip5, in Sep. 2014. In the 14th ITTFSSC 2015, the breakthrough which I seriously consider a major TT technical development was presented in theory as a scientific research paper.

By implementing analytics for the technical, physical and mental factors inhibited in coaching/learning the style switching procedure, in perspectives of both the coach/trainer and player should enlighten the innovative style’s basic features as well as points of distinguish from other styles.

As this is not a simple case study, the analytical study of the TT sport’s breakthrough technical playing system, e.g. the MG- Ship style, is best enhanced with observations from practical application on the table by one junior and/or one youth players, while measuring by possible means the difficulties as well as the achievements faced/gained by both instructor and players.

The research study strives towards a vivid comprehension and appreciation of the new “MG-Ship” style enabling vision of injecting fresh blood into our TT sport world veins as well as aspiration to thousands of future table tennis athletes questing dreams achievement with an innovative, different, technical style.

Key words: *The MG- Ship, style, coaching, junior, youth, player*

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THE EFFECTS OF THE SELF-TALK TYPES AND TASK COMPLEXITY ON THE ACCURACY OF FOREHAND TOP SPIN OF ADVANCED PLAYERS

Abstract

The purpose of this study was to determine the effects of the motivational and instructional self-talk and task complexity on the accuracy of forehand top spin of table tennis in advanced players. The 30 male advanced (28±10.6 years old) were divided into 3 groups (2 experimental and 1 control). The task complexity was determined by color of ball and impact place. In other words, sequence sending of the ball were changed after two balls and this trend continued. The keywords for motivational self-talk was "I can do" and " I correctly recognize", and for Instructional self-talk “pay attention” and "Close your paddle". Masters and et.al test (2008) was used to measure the accuracy of forehand topspin. After the pre-test, subjects took part in 6 training sessions including 20 trails per session. After 48 hours, they participated in post-test. The data were analyzed by paired-samples t-test, one way ANOVA and Bonferroni post hoc test. Results showed that there is a significant difference between the instructional and motivational self-talk in terms of task complexity. These findings suggested that instructional self-talk is the effective variable in performance of tasks that needs high complex decisions and accuracy.

Key words: *instructional self-talk, motivational self-talk, task complexity, table tennis*

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STUDIES OF THE INFLUENCE OF BALL SIZE AND NET HEIGHT ON TABLE TENNIS TRAJECTORY DISTRIBUTIONS

Abstract

One possible measure to increase the medial appeal of table tennis is to slow down the game by using bigger balls or higher nets. In this work, the equations of motion for table tennis balls are solved numerically on GPUs (Graphics Processing Unit) by CUDA (Compute Unified Device Architecture), which gives a very large speed-up compared to CPUs. This allows analyzing five billion different initial conditions for systematical, statistical studies of the impact of ball size and weight as well as of net height on the distribution functions of successful strokes.

Hitting locations, initial spins and velocities in terms of values and directions are varied by Monte Carlo sampling and the resulting distributions of successful trajectories were analyzed. The absolute values of the translational velocities were limited to 20 to 200 km/h, the spinning velocities to 0 to 150 turns/s (topspin, sidespin and backspin were included). A ball is counted as a successful ball if it passes the net within the height limit (30 cm above the net height) and hits the other side of the table tennis table.

The analysis confirms the empirical observation that the change of the ball in the year 2000 from a 38-mm to a 40-mm-ball can be compensated with other parameters such that their resulting trajectory distribution functions are nearly identical. The player’s technique compensated the larger ball size. Up to now, a further increase of the ball size is the preferred correction action to reduce the maximum velocity in table tennis rallies. A larger ball of 44 mm with small weight is one option for suppressing high velocities, coupled also to a reduction of the influence of spinning. Alternatively, an increase of the net height is possible. A small increase of the net height could be one future option, where the basic character of the game is mostly conserved, but especially the influence of the service could be reduced.

Key words: *rule changes, GPU computing, Monte Carlo methods*

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TECHNICAL ANALYSIS OF THE 2016 RIO OLYMPIC GAMES WOMEN'S SINGLE TABLE TENNIS CHAMPIONSHIP COMPETITION

Abstract

2016 Olympic women's single table tennis champion Ding Ning, and her final opponent, runner-up Li Xiaoxia were subjects of this study. Using analysis chart of table tennis three-staged techniques to compare these two players' performance during championship competition, coaches in Taiwan can base this as a training reference. By doing statistical analysis and discussion, the conclusions were made as shown in the followings: (1) Using the three-staged techniques scoring rate, Ding Ning rated "excellent" both in 'attack after serve' and 'attack after receive', with "good" in 'rally'. Her techniques showed fast speed, fast tempo, and powerful serve which could gave opponent fatal blow to win a point. At the same time, with game tactic needs of second and third hit, stable forehand and backhand skills could also win the point. Because of her excellent skills in serve, receiving serve, and defense, positive attitude with vigorous attack when rallying with opponent were the reasons for her to won single table tennis championship in 2016 Rio Olympic Games. (2) The three-staged techniques scoring rate of Li Xiaoxia although showed up to a certain standard, but obviously was no better than Ding Ning. Overall, it showed "fail" in 'attack after serve', "good" in 'attack after receive', and "excellent" in 'rally' on the scoring rate. She should try to raise the scoring rate of 'attack after serve' and 'attack after receive' in order to achieve better results when playing major games.

Key words: *table tennis, three-staged techniques, attack after serve, attack after receive, rally*

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CASE STUDY OF NATIONAL KAOHSIUNG UNIVERSITY OF APPLIED SCIENCES' STUDENTS INTEREST IN LEISURE SPORTS WHOM HAD TAKEN TABLE TENNIS COURSES

Abstract

At National Kaohsiung University of Applied Sciences (KUAS), students have options to choose specialized sport courses as part of their physical education curriculum. The main purpose of this study was to investigate whether the sport would stick with the students and have perceived positive impact for the future for those who chose table tennis. A total of 322 surveys were analysed. Frequencies, percentages, means, standard deviations, t tests, one-way ANOVA and Scheffe's method were used for the study. The results of the study could be used as a teaching reference. The summary provided below was based on the analysis: (1) The top three leisure sports with highest participation were table tennis, jogging, and weight training. There was no significant difference in the participation rate between male and female students. Moreover, most students hoped to spend 500 NT or less per year for exercise related expense. (2) The top three motives for students to participate in leisure sports were to be healthier, to relax, and to have fun. Lack of time was the top reason to prevent students from participation. (3) Table tennis school team players were more likely to pursue the same sport during their spare time and in the future. They were also more willing to spend money for the sport. (4) Most students had positive experience in taking table tennis course, especially in terms of learning the techniques and gaining confidence in the sport. (5) Regardless of the age groups, by joining table tennis competition, many players felt the game helped them mentally, spiritually, and physically.

Key words: *table tennis, motive, exercise pursue*

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DEVELOPING OF A FLIPPED CLASSROOM LEARNING SATISFACTION SCALE ON UNIVERSITY TABLE TENNIS PROGRAM

Abstract

Flipped classroom is an innovative teaching method that helps teachers to move away from direct instruction as their primary teaching tool toward a more student-centered style. The purpose of this study was to develop a satisfaction scale for teaching and learning in university table tennis teaching program based on flipped classroom method. 144 National Chung-Hsing University students (90 males and 54 females, mean age 18.76 ± .731) have participated in the pre-test. The questionnaire was summarized and drafted using the concept of "flipped classroom" as the main axis and complemented with relevant PE teaching methodological literature. 20 questions were screened out and selected for the preliminary questions after the item analysis. Then five dimensions were extracted by factor analysis and became the formal scales. The name of each scale and its Cronbach's Alpha were as follow: Film Preview (α=.816), Program Design (α=.817), Self-correcting (α=.771), Assignment (α=.755) and Cooperative Learning (α=.500). This study showed that ''the scale of learning satisfaction, when applied to a flipped classroom, had a good reliability and validity. It is an important reference for table tennis teachers in the teaching design of the "flipped classroom."

Key words: *table tennis, program design, innovation teaching, Likert scale*

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THE STUDY OF CHINESE TABLE TENNIS CROSS-CULTURAL TRANSMISSION BASING ON THE STRATEGY OF "THE BELT AND ROAD"

Abstract

This paper mainly uses the method of literature data to refer to relevant documentations that related to table tennis or culture transmission and uses the method of comparative analysis to choose the useful documents and analyse the connection and significance of these literatures. The study mainly discusses from these four aspects, the connotation of table tennis culture, the direction and content of Chinese table tennis culture cross-cultural transmission, necessity and ways basing on the strategy of "the Belt and Road". It is aim to spread table tennis culture through the countries along the route of "the Belt and Road", and to promote table tennis popularization and better development. The research results show that the connotation of table tennis culture is the sum of the spirit, system and material of table tennis which is formed in the process of social practice around the table tennis. The direction of table tennis cross-cultural transmission is transmitting to those countries along the route of "the Belt and Road". The content is utensil culture, institutional culture and spiritual culture about table tennis culture. The necessity of table tennis cross-cultural transmission has four points as follow. First, it is the requirement of improving the country's culture soft power and enhancing the words power. Second, it is the inevitable result of sports globalization. Third, it is Chinese responsibility and obligation as ping-pong powerful country. Forth, it is of great significance to promote the strategy of "the Belt and Road". So this paper comes up with four transmission ways. First, we must speed up the construction of table tennis cultural transmission infrastructure and industrial development platform. Second, we should adhere to combine going out with bring in, respect and learn with each other. Third, it must enrich the contents and forms of table tennis culture communication and cooperation. Last, we should tell the story of Chinese ping-pong well by means of the new media.

Key words: *"the Belt and Road", table tennis, cross-cultural, transmission*

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ANALYSIS OF THE DURATION RALLY AND REST TIME OF WHEELCHAIR PARA TABLE TENNIS AT THE RIO 2016 PARALIMPIC GAMES

Abstract

The purpose of this study was to analyse and compare the match characteristics of wheelchair Para table tennis classes that played in the team tournament at the Rio2016 Paralimpics. Eight Para table tennis matches of each selected class (1, 2, 4 and 5) were analysed. The variables analysed were; duration of rally (DR) and rest time (RT). In observing the characteristics of the matches in classes 1, 2, 4 and 5, the DR corresponded to 3.4±1.2, 4.2±1.5, 4.5±1.6 and 5.2±1.2 seconds, and RT to 13.8±3.5, 14±3.5, 13.3±3.1 and 12.3±3.3 seconds. In classes 1 and 2, significant differences in DR were found, but none in RT ($p>0.05$). In the DR and RT of classes 4 and 5 there were significant differences ($p<0.05$). The results indicated that the DR in classes 1 and 2 were different because of sitting balance due to severe reduction of function in class 1 playing arm, interfering in the rally and rest. In classes 4 and 5 the differences in DR and RT were caused by little sitting balance in class 4. These characteristics should be used by coaches to check the disadvantages that class 1 presents against class 2, and the physical limitations of class 4 that can directly influence DR in the team tournament against athletes with normal trunk muscle function (class 5). Planned training prescriptions between classes would aim at achieving better sport performance in training and team tournaments.

Key words: *para table tennis, sitting classes, rally, rest time*

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A NETWORK ANALYSIS OF TABLE TENNIS MATCHES PLAYED IN ITALY

Abstract

This study proposes a network analysis of the complete set of table tennis matches played in a Country. A wide dataset concerning all results registered by the Italian Table Tennis Federation (FITET) is considered. The dataset includes about 1 million matches played by 26k tennis table players in last 8 seasons. In the resulting directed and weighted network, players are represented by nodes and matches by arcs between nodes. We investigate the main features of the network, which shows scale-free and small-world properties, typical of a "complex network". The scale-free degree distribution indicates that few players played a relatively high number of matches, while most players with few matches are in the long-tail. In addition, most nodes are connected by very few edges. Assortative mixing is positive, to indicate that players often play with other players having similar degree.

A second analysis focuses on the correlation between the improvement in ranking position and centrality measures, in one season. The favourable position of an athlete in the network, as identified by betweenness, closeness, eigenvector and degree centrality is positively correlated with the improvement in the final ranking. This underlines the importance of the adversaries and the kind of tournament an athlete is playing (i.e. young or adult adversaries, specific tournaments or Championship). Finally, we investigate the main topological features by applying community detection algorithms, which help in detecting groups and communities. Visualisation allows to clearly identify these features and structural patterns.

Key words: *match analysis, social network analysis, data mining*

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THE STUDY ON NURTURING TERTIARY STUDENTS AS DOCTOR FOR UNIVERSITY SPORTS TEAM IN MEDICAL UNIVERSITY - A CASE STUDY ON TABLE TENNIS TEAM OF DALIAN MEDICAL UNIVERSITY

Abstract

Along with extensive development of sports activities in China, Governments have been putting more and more emphasis on sports skills of tertiary students. Sports competitions in universities are flourishing on more and more classes of sports, not only sports events incorporated in Olympic Games but also those not included in Olympic Games, for instance, frisbee, orienteering, skidding and etc. Universities organize their own teams to participate in all levels of competition. However, sports injury incurred in sports activities is the common conundrum that every sports team has to deal with. Tertiary students in medical universities have competitive advantages in intertwining sports and medical knowledge and becoming medics or doctors for sports team by applying their knowledge gained during study to mitigate the damage to sportsmen. This study, with Documentary Analysis Method and interview method, aims to analyze and research on the reasons of sports injury from aspects of physiology and anatomy. This study also analyzes the advantages and issues associated with tertiary students in medical universities being doctors in sports team in order to provide theoretical basis for nurturing medics in sports team in medical universities and other colleges.

Key words: *medical university, students, sports team, doctor, medics, feasibility*

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STUDY OF NATIONAL GAMES' TABLE TENNIS TAINAN MEN TEAM 22 PEAT DEVELOPMENT COURSE (1984 – 2011)

Abstract

The fact of that Tainan men table tennis team hit 22-peat for the National Games from 1984 to 2011 has made the remarkable records of table tennis competition in National Games. My study aims to study Tainan men table tennis team training process and key factors to reach 22-peat. The research methods took mainly historical research and partly interview to collect data. To follow were the results which were based on the collection of data.

First, it didn't go smoothly to win the games every year. There were five time peat was almost discontinued due to high competitive tournament. Fortunately, they won the games by their actual strength. The financial support came from City Hall, Central Table Tennis Committee, and Cooperative Bank.

Second, Tainan men table tennis team was established in 1977 by coach Mr. Chung-Hsiung Lin. There were 43 players in total to participate and won 22-peat games in 27 years. Many players were selected to become national players and passed down their strength of good convergence to next generation.

Third, the coach trained players individualized. He planned the whole training programs not only in skills and physical training, but also in psychological counseling. While era and ideas have changed for the past thirty years, the methods of management have also changed from the militarization to democratization.

Fourth, four points were the key factors to win 22-peat: (1) An unimpeded channel to university attracts good players to come to be trained. (2) Discipline and obedience were emphasized in strict team training and management. (3) Good team understanding and high cohesion. (4) Good experience inheritance made no lack of talent.

Key words: *Tainan men tables, national games, Lin Chung-Hsiung, Tainan City*

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ANALYSIS OF MENTAL STATE OF ATHLETES UNDER PRESSURE USING ELECTROENCEPHALOGRAPH (EEG)

Abstract

There is a close relationship between training and competition in all competitive sports. In this sense, the method of daily training is important to get good results in the competition. However, athletes experience often to fail to show their skill in the game which they have mastered in the training. Table tennis is the sport in which delicate control of small and light ball is decisive to win or lose the game. Even top players in the world make a simple mistake in the game. Such a mistake is related to psychology of the players. Thus, mental control is very important for athletes to keep good playing skill.

If athletes follow reasonable training methods, they are able to improve the quality of training in the same psychological state as in the game. If regular patterns of players' psychology in normal practice are understood, it is possible to take advantage of the understanding to developing effective measures which enable players to adjust their mentality so that they can play the game with a good state of mind. The purpose of this work is to find that possibility based on brain waves measured by an electroencephalograph (EEG).

In this work, influences on brain waves of coaching method and calling of coaches to players were investigated to see the mental state of players. To examine the changes of mental pressure in accordance with the scene of the play, a few cases were selected from the normal training program for the investigation.

Case 1 is the one where a player is required to count the number of rally during the play and to hit the ball according to the instruction. The results of Case 1 showed that the player has higher concentration. Case 2 is the training of block defense against an offensive opponent. It was found in Case 2 that the player feels some modest pressure and tends to become nervous. It is expected to develop the training method which makes mental state in the training similar to that in the competition.

Key words: *mental state; electroencephalograph (EEG); coaching method*

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THE THINKING OF TABLE-TENNIS' GLOBALIZATION DEVELOPMENT

Abstract

By looking for the relative literature and doing an expert interview in this paper, a study is made on table tennis, which is about its present situation, existing problems and how to realize the globalization. The table-tennis status of China is the overlord in the word and China swept all awards at three table tennis world matches, although a series of measures are executed by ITTF, but the situation that China compete with world is still not changed. In addition to Chinese monopoly, some problems are still in there and restrict the table tennis development to globalization, such as the masses foundation is thin, the publicity effort is not enough, the next generation talent is shorted, this sport is lake of enjoyment and innovation, the number of these countries who are willing to undertake the international competition is going to be less and less, the match kinds in Olympic Games is decreased. Some suggestions are given: (1) Strengthen the revisement and improvement of competition rules. (2) China is powerful in table tennis, so China can make full use of this advantage to realize these perfect resources' global sharing (3) enhance cooperation with the world's main media and expand table-tennis' influence. (4) hold all kinds of matches, pay more attention to both competition and public. (5) promote the fancy table tennis actively and improve its ornamental. (6) attract more people to participate in this sport by means of celebrity effect.

Key words: *table tennis, globalization, development*

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THE CURRENT SITUATION AND THE DEVELOPMENT PROSPECT OF PUBLIC TABLE TENNIS RATING GAME IN CHINA

Abstract

The public rating game has become increasing popular in China. This paper makes investigation upon the current status of the public table tennis rating game in China via the research upon literature review, expert interview, questionnaires, mathematical statistics, comparison analysis research methods, based on the rating game mode and sport E-marketing as the theoretical foundation. Comparisons are made between various periods of the developmental process, finding out the influential factors of the public table tennis rating game and making analysis upon it, at last, the league match advantages and main problems are pointed out, and the developmental strategies and suggestions are put forward. The conclusions are as follows:

1. Although the number of people and matches of the public table tennis rating game in China has been largely elevated, they are also staying at the early developing period. There are certain regional characteristics upon the match and gym distribution. There are more online platforms in cities, and the more gyms are located in the urban skirts than those in the city center. Meanwhile, there are many existing dormant members.
2. The rating game has gone through the process in which it is originally introduced from the governing institute (CTTA), and it has gone on a broad spreading among the public, and at last, it is accepted by the super stratum. The public rating games are prevailingly developing at the bottom group of the "pyramid", that is to say, they are individually operated by online platforms, via the organization model cooperated with the clubs.

The influencing factors of the rating games include: attractive factors of the matches; systematic and fair factors; social support and cooperation; players; and qualification.

Key words: *table tennis, public, rating game, current situation, prospect*

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DOES ELITE SUCCESS HELP TO PROMOTE PARTICIPATION IN TABLE TENNIS? A LONG-TERM ANALYSIS OF TRICKLE-DOWN EFFECTS IN GERMANY, FRANCE AND AUSTRIA

Abstract

Associations and policy makers often try to use successful athletes as figureheads who shall inspire more people to participate in a sport. However, former research indicates that success does not trigger mass participation in general, but only may do so in rather specific constellations (De Bosscher et al 2013; Frick and Wicker 2016; Weimar et al 2015). This relation shall be studied for the case of table tennis from an international, comparative perspective. For this purpose, long-term membership figures (since 1960s) of table tennis associations in Germany, France and Austria were collected. Multivariate statistical analyses, including indicators of sport activity and of performances at international championships, are used to measure possible effects of elite success on mass participation. Preliminary analyses suggest partly paradox effects: Only the French case indicates systematic effects in both the Secrétien and Gatien era. In the case of Germany, table tennis grew stronger than other sports after a successful 1969 WTTC at home, but stagnated or decreased – more than other sports – in the even more successful years since 1989. The Austrian case indicates a "Werner Schlager effect", but rather after the "minor" early success (1999 bronze medal) than after the 2003 world championship. Thus it shall be discussed in detail under which conditions and in which way elite success may be a trigger for mass participation in table tennis.

Key words: *trickle-down effect, participation, legacies, talent development*

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THE TECHNICAL AND TACTICAL ANALYSIS ON MA LONG VS MIZUTANI JUN IN SEMI-FINAL MATCH AT 2016 OLYMPIC GAME

Abstract

The purpose of this study was to analyze the technique and tactics used by Ma Long and Mizutani Jun in semi-final match at 2016 Olympic Games by the method of the classic three-phase method with the Simi Scout technical and tactical analysis software, in order to provide some suggestion for Chinese table tennis player's tactics training. The main results were that there were total 102 points in this game. Ma Long won 60, and lose 42. The scoring rate and using rate of serve and attack phase was 70.6% and 33.8%. The scoring rate and using rate of receive and attack phase was 45.8% and 23.5%. The scoring rate and using rate of rallies phase was 56.7% and 43.1%. The main conclusions were as followings. (1) The techniques of Mizutani Jun's receive were prior to the technique of short cut Ma Long's medium and forehand. The other choice of receive was the long cut at Ma Long's backhand. (2) The drop points of Ma Long's serve were mainly at Mizutani Jun's short middle and forehand, and occasionally at long backhand. (3) Ma Long cut long to Mizutani Jun's backhand had no good effect when he received the Mizutani Jun's medium short serve. (4) Ma Long used the forehand mainly to win the sore in the rallies phase. The forehand was the main winning technique for Ma Long. (5) Ma Long should pay attention to Mizutani Jun's changing the hitting line at the rallies stage, especially from backhand to forehand.

Key words: *Ma Long, Mizutani Jun, technical and tactic analysis*

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OUR EFFORTS TO SAVE THE FUTURE OF PEN-HOLD GRIP – DISCUSSION ON THE FUTURE DEVELOPMENT OF PEN-HOLD GRIP IN TABLE TENNIS

Abstract

With the retirement of Chinese table tennis athletes Ma Lin and Wang Hao, now only has Xu Xin using penhold grip in National Team. There are fewer penhold learners in China. This situation has indicated that penhold grip is fading. To save penhold, the author and coach Lin Wen Bin, have gone through in-depth research and found that the traditional penhold grip is only suitable for quick attack style with pips-out rubber but not for looping with inverted rubber. This is a natural structural limitation of traditional penhold grip. With in-depth research by Coach Lin Wen Bin, he came up with a new innovative new design which he has already patented. With the new design, it resolved the ergonomic limitation of the traditional penhold grip. The bat with the new grip inclines naturally in an approximate 50 degree angle with the surface of the table; which make the fast looping stroke in a ready position. There is much less adjustment to be made compare to the traditional penhold grip. We strongly believe this is a new starting point for the penhold grip. The reformed new model of penhold grip should make good use of both sides of forehand as development direction: using forehand's front side for skills and forehand's back side as supplementary and should retain original straight tuidang technology. But with Wang Hao style's penhold backhand technology as major skill for reposition. Hoping this will be the milestone for future penhold grip athlete with reformed techniques.

Key words: *table tennis, traditional penhold grip, new model penhold grip, V shaped cavities, new development direction on China penhold technique and tactics*

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COMPARISON OF GAME CHARACTERISTICS OF LONDON (2012) AND RIO (2016) OLYMPIC TABLE TENNIS GAMES

Abstract

This study aimed to estimate some changes of table tennis game characteristics by a comparative analysis of London (2012) and Rio (2016) Olympic Games and predict the tendency. Sixteen games, from quarterfinals to finals, consisting of 1502 rallies and 7754 strokes, were analysed by notational analysis method. The data of types, effects and placements of every stroke was collected based on a customized observation tool. The results showed no significant difference in the average strokes per rally ($p>0.05$, from 5.67±0.86% to 4.91±0.66%). However, a significant ($p<0.0001$) difference was found in the proportions of stroke types (topspin decreased from 45% to 42%, block increase from 9% to 14%), the distribution of return placement (long decreased from 18% to 9%, middle increased from 47% to 54%) and the effect of strokes (neutral decreased from 63% to 48%, positive increased from 23% to 29%, negative increased from 14% to 23%). These findings indicate that the stroke difficulties and complexities have increased. Since the characteristics of table tennis games have changed greatly, coaches and players have to preparing for training and competition according to new conditions.

Key words: *match analysis, table tennis, Olympic Games, skills and tactics, game characteristics*

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NONCONVENTIONAL TECHNIQUES ANALYSIS FOR ALL-ROUND ATTACK IN TABLE TENNIS

Abstract

All-round attack paddle is a new one where conventional hand-and-shake grip and pen-hold grip are originally combined. Its uniqueness is that forehand backside attack is developed. Thus, “all-round attack with pen-hold grip”, which is able to attack in frontal and backside forehand and frontal and backside backhand, is formed. All-round nonconventional techniques refer to technical actions, which are used in specific conditions, applied in a low frequency, and not generally normalized. Its production mechanisms mainly include physiological mechanism, psychological mechanism and training theory mechanism; and characteristics are mainly presented as inter-constructional co-variation, abnormality, reasonableness and practical effectiveness. This article applies literature and the like to analyze concept, classification, production path, occurrence mechanism, basic characteristics and functions of nonconventional techniques in all-round attack. On this basis, it is discussed whether nonconventional techniques are reasonable for table tennis and able to be trained and cultivated. Besides, opinions are presented in regard to development of nonconventional techniques.

Practice basis of statistics for nonconventional technique of all-round athlete matches, it can be concluded that: Nonconventional technique of all-round attack has favorable practicality in matches. By statistic and analysis of athlete in matches, it can be found that there is 39% probability of nonconventional technique during use to cause direct mistake of the opponent; at the same time, probability of the opponent to hitting back favorably is only 2.5%. It proves sufficiently that nonconventional technique of all-round attack method has favorable practicality in matches. Nonconventional technique of all-round attack is technique that can be cultivated and improved and has development space. Nonconventional technique of all-round attack is not complete and error rate in matches reaches 23%, which is hidden danger of nonconventional technique of all-round attack and simultaneously provides sufficient space for its development. Therefore, nonconventional technique of all-round attack method is a kind of technique that is beneficial to all-round attack for competition and has promotion function to victory of matches. At the same time, all-round nonconventional technique is still in exploration period and practice effect is more to be improved.

Key words: *table tennis, all-round attack, nonconventional techniques*

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THE INFLUENCE OF LEISURE MOTIVATION AND EXERCISE INVOLVEMENT ON EXERCISE HABIT

Abstract

This study examined the relationship between leisure motivation, exercise involvement and frequency of exercise habit of undergraduates in Table Tennis. The following research questions were addressed: leisure motivation and exercise involvement were positive significantly associated with each other; exercise involvement and frequency of exercise habit were positive significantly associated with each other; leisure motivation and frequency of exercise habit were positive significantly associated with each other. Five colleges' students, namely Living Technology, Management, Design, Arts and Tourism were selected. Participants were 328 Table Tennis course students (156 male, 172 female) in college of Living Technology (n=67), Management (n=69), Design (n=61), Arts (n=65) and Tourism (n=66). The data obtained from survey were then analysed by using SPSS program. Descriptive and inferential statistical methods such as t-test, one-way ANOVA and correlation analysis were used to analyse the research data. Findings of this study demonstrate that both leisure motivation and exercise involvement had a significant correlation in the frequency of exercise habit. The results will be discussed and could be useful to increase the health-enhancing exercise habits.

Key words: *physical education course, table tennis, correlation analysis*

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RESEARCH ON PREPARATION MODE FOR INTERNATIONAL MATCH OF CHINA NATIONAL MAN'S JUNIOR TABLE TENNIS TEAM

Abstract

Using the method of literature, video observation, mathematical statistics and so on, this paper takes a research on the mode of China national man's junior team of table tennis prepared for the Asian and World Junior Championship in 2016, It analysis the application of the model in two games, reveals out the scientific and systematic characteristics of the arrangements of main preparation.

The scientific preparation of China national man's junior team is consisted about 30 days high-intensity joint training combined personalized and competed training. It is an omnidirectional preparation mode involved training, physical, psychology, nutrition and healing. The mode consists of the following blocks:

1. Clear guiding ideology and competition target.
2. Athletes selection using public competition combined with individual integral.
3. Preparation training usually starts one month before the game.
4. The training plan combined by fundamental and individual training, especially in three times training a day.
5. Dope out the major competitors, and established the database of the opponents characteristics about advantages especially disadvantages
6. Targeted and defeated training which simulated opponents.
7. Mobilization mechanism relays on team inter emulative competitions.
8. Psychological and volitional quality exercised by watching match videos and simulated key game scenes, especially increasing the difficulty of the opponent.

Key words: *China national man's junior team; International match; preparing mode*

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RESEARCH ON RESPONSE INHIBITION OF TABLE TENNIS PLAYERS WITH DIFFERENT LEVELS

Abstract

Objective: This study was designed to discuss the response inhibition (RI) of table tennis players with different levels, to learn the relationship between table tennis experience and RI.

Methods: We assessed the effect of table tennis experience by Go/No-go task in high-level group (13 active athletes of the Chinese table tennis team), medium-level group (14 secondary table tennis players) and low-level group (13 beginners); experimental materials relevant and irrelevant to experience were selected; in addition, in order to improve the ecological validity, we attempted to change the Go/No-go task's reactive mode from press short-distance keys to press long-distance keys.

Results: 1) In the short-distance key press task, the reactions of high-level group in general cognitive tasks were obviously shorter than the others ($p<0.01$, $p<0.001$) and in experience tasks, their reactions were also obviously short ($p<0.01$, $p<0.001$). There was no difference between medium-level group and low-level group ($p=0.411$, $p=0.225$). The error rate of high-level group in experience task was obviously less than low-level group ($p<0.05$); 2) In the long-distance key press task, the RI advantage of high-level group further expanded, and the react time of medium-level group was obviously less than the low-level group in the task relevant to experience ($p<0.001$).

Conclusions: Compared with beginners, elite table tennis players have better RI, whose advantage was not only embodied in task relevant to experience, but also could be transferred to the general cognitive tasks. The secondary table tennis players only had the advantage of RI in tasks relevant to experience.

Key words: *table tennis, experience, response inhibition, response distance*

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THE EVALUATION OF ANTICIPATION ABILITY FOR TABLE TENNIS PLAYER: BASED ON HICK'S LAW

Abstract

Hick's law predicts that response times increase as a log2 function of the number of stimulus-response (S-R) alternatives. Numerous studies have shown that one of characteristics of expertise in many reactive skills is the ability to use advance visual information to reduce their reaction time. To further quantify the nature of the expert advantage in anticipation, we employed a novel cuing task that cuing a nine-choice task with a table tennis video clip. The landing location of the ball correctly indicated the location of the response target 75% of the time. Based on Hick's law, the number of S-R alternatives was collected in 34 participants, including 17 professional table tennis players and 17 controls (non-athletes). Results showed both players and controls reduced the number of S-R alternatives to below nine because of anticipatory of table tennis. And players generated smaller number of S-R alternatives than controls. Additionally, only for the players, the number of S-R alternatives was gradually reduced with the increasing advanced information load. Taken together, these findings suggest that the nature of the expert advantage in anticipation is the ability to make use of information to gradually reduce the number of S-R alternatives.

Key words: *Hick's law, anticipation, table tennis, expert*

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CASE STUDY: USING VIDEO ANALYSIS OF MATCHES TO TRACK PLAYER PERFORMANCE AND INFORM TRAINING

Abstract

This case study describes how video analysis of matches was used to track player performance and inform training. Over a two week training camp, two-highly trained junior players competed four times in a 'best of 5 sets match' against a player of similar age and playing ability. For Player 1 selected key performance indicators (KPIs) per set of total unforced errors and service return errors were video tagged and noted. For Player 2 KPIs of total unforced errors and footwork errors were video tagged and noted. Following each match the tagged video was uploaded to dartfishtv™ to be reviewed by the player, coach and analyst. The coach highlighted high error-counts for both players in each KPI after Match 1 and was concerned to see the counts increase by + 14-90% after Match 2. Post-review, the coach decided to modify training drills with more focus on match situations with players starting every drill with a serve or return. With the exception of total unforced errors (+24%) for Player 2 in Match 3, all KPI counts were reduced from Match 2 to Match 3 (- 32-40%) and reduced further to the minimum values in Match 4 (- 23-72%).

The simple but effective use of video analysis can help an experienced coach to track player performance by identifying key indicators for a player's style of play. By applying this approach systematically a coach can use the information to modify training accordingly thereby closing the loop of: training – match – analysis – training.

Key words: *table tennis, video analysis, tracking, performance*

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RESEARCH ON SCORING CHARACTERISTIC, CAUSES AND DEVELOPMENT OF TECHNICAL AND TACTICAL APPLICATION IN COMPETITION OF MALE ATHLETES IN NEW ERA

Abstract:

With the methods of mathematical statistics etc. the scoring characteristics, causes and development of technical and tactical application in male athletes' matches in new era are studied to provide reference to scientific training and competitions of table tennis teams. The conclusion shows that the scoring characteristics of technical and tactical application are characterized by two big parts and two small sub-parts in new era. The first part includes 1st to 4th boards, when the scoring ratio in shot sequences declines sharply and the scoring ratio each board in serving round is noticeably higher than that of receiving round. The second part includes the 5th and the subsequent boards, when the scoring ratio rises and falls in shot sequences, with slight fluctuations. Scoring ratio in serving round is equal to that in receiving round, which is difficult to produce positive effects for winning-game. Compared with the 7th and the boards of the second small sub-part, the scoring characteristic of 5th to 6th board of the first small sub-part resembles the first part. Once the application ratio exceeds 5‰, only 1st to 3rd board can produce a positive influence on matches. The difference in scoring characteristics stems from the distinction of technical and tactical confrontation in each board. The scoring characteristic of 1st to 8th board is cross-event consistent, while that of 9th board and the subsequent boards has a marked difference as shown by very little samples. The application of techniques and tactics in each board keeps changing during the whole process, especially during the 1st to 6th board.

Key words: new plastic ball; male athletes; technique and tactic; scoring characteristic; development tendency

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DIFFERENCES IN MATCH STATISTICS DURING TABLE TENNIS TEAM EVENT IN RIO AND LONDON OLYMPIC GAMES

Abstract

The aim of this study was to analyze game statistics at different phases of the game by the table tennis players at Olympic Games in Rio 2016 and London 2012, by determining the differences in game statistics indicators in these two competitions. We analyzed 236 games matches from Rio and 214 games matches from London, played during team event. From each game were collected 27 parameters. In this analysis, the average match and rally durations with different rally analysis among 16 teams played at Olympics has been provided. The official website of 2016 Rio Olympics and 2012 London Olympics were used as a means of collecting data and during the matches, the results and analysis of a total 450 matches published on this site were recorded and evaluated. The study was carried out on total of 346 players (174 women and 172 men) who participated from 16 countries. Descriptive statistical analysis of data (mean, standard deviation, minimum and maximum values, percentage distribution) was done by using SPSS 17.0 for Windows.

Statistically significant differences in performance indicators between the table tennis matches played on the Olympic Games in Rio and London are found for the variables: Whole match duration / without breaks between sets, Game duration of 1st set, Game duration of 2nd set, Game duration of 3rd set, Game duration of 4th set, Total points won in match and Total points lost on own serve in whole match (all in the direction of higher means for the matches played in Rio Olympic Games). The only statistically significant higher mean for the matches played in London Olympic Games is found for the indicator Total points won on own serve in 5th set. When looked at the data obtained in this study, it is observed that the highest mean match durations are influenced by the style of play and the longest mean rally durations comes with defensive players. As a conclusion, according to the 2016 Rio Olympics and 2012 London Olympics analysis, table tennis coaches must revise technical and tactical elements when playing on best of five matches and they have to prepare special schedules for category properties. The results presented are important to monitor the athlete's performance during the game and to readjust strategies based on point difference.

Key words: *table tennis, London Olympic Games, Rio Olympic Games, match analysis*

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EFFECT OF DIFFERENT SHAKE-HAND GRIP ON BACKHAND "CHIQUITA" VELOCITY

Abstract

Purpose: The purpose of this study was to observe the effect of different shake-hand grip on backhand "chiquita" velocity and to discuss the effect of difference shake-hand grip on backhand "chiquita" velocity. Methods: Method used observation and testing examination. Fifteen collage males' table tennis athletes (21.13 ± 2.92 years, 175.80 ± 5.74 cm 69.31 ± 11.10 kg) who are shake-hand grip table tennis player participated in this study. The subjects successfully performed threes backhand "chiquita" under two conditions as follows: new shake-hand grip and traditional shake-hand grip. Speed gun was used to measure backhand "chiquita" velocity. Results: A paired t-test analyses of variance revealed no differences in backhand "chiquita" velocity among the two conditions ($p = 0.187$). Conclusion: Although, this study showed no different backhand "chiquita" velocity regardless of new shake-hand grip or traditional shake-hand grip. Future research is needed to analyse the effect of different shake-hand grip on bio mechanic.

Key words: *speed gun, table tennis, collage males*

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BRAIN PROCESSES ASSOCIATED WITH FASTER VISUOMOTOR REACTION TIME IN RACQUET SPORT ATHLETES

Abstract

Visuomotor reaction time (VMRT) is a key determinant for performance in racquet sports such as table tennis. This study aimed to identify the neural perceptual and motor-related correlates of VMRT in athletes and non-athletes; a fundamental step for individualized training regimes aiming to improve VMRT.

Electroencephalography (EEG) was used to investigate pattern-reversal and motion onset visual evoked potentials (VEP) in 36 top class badminton players and 28 age-matched non-athletic controls. Subjects were asked to respond to visual stimuli as quickly as possible using a button press thus, allowing to analyze visuomotor transformation processes and to determine VMRT. Furthermore, the latency of muscle activation onset was identified using electromyography (EMG).

Athletes exhibited an earlier EMG onset and shorter VMRT in response to both contrast (EMG onset: $p=0.015$; VMRT: $p<0.001$) and motion (EMG onset/VMRT: $p<0.001$) visual cues. This was accompanied by a faster visuomotor transformation as reflected by an earlier activation of the pre- and supplementary motor regions in both conditions (contrast: $p=0.015$ motion: $p=0.009$). The athletes' visual perception was faster for motion ($p=0.002$) but not contrast visual stimuli ($p=0.6$). Neural variables predicted visuomotor performance across all subjects (contrast: $r=0.41$, $p<0.001$; motion: $r=0.83$, $p<0.001$) and within the athletes' group (contrast: $r=0.43$, $p=0.03$; motion: $r=0.8$, $p<0.001$).

These results indicate VEP analysis is an important tool to assess individual differences in visual perception and visuomotor transformation. Therefore, it is of great value for table tennis athletes and coaches aiming to set individual training parameters to improve VMRT.

Key words: *vision, reaction time, EEG, sport, athlete, visual evoked potentials*

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THE DISCUSSION ABOUT TABLE TENNIS' DEVELOPMENT IN CHINA AND WORLD

Abstract

Table tennis as a national sport in China, so China have gained the advantages condition and realized multiple sweep in the world table tennis competition such as the World Cup, the Olympic Games and the world championships at recent decades. China, she makes a great contribution on innovating skill and tactics, updating equipment and changing rules, she also promotes the table-tennis' development in the world. At the same time, this Chinese hegemonic position in the table tennis project also bring many negative effects, such as the unfair development in every local, the near extinction of chopping technique, the decreased turnout year by year, the frequent transformation of match rules. As an athletic powerhouse and a table-tennis powerful nation, China must embark from the general situation and make the utmost of its advantages and take further steps to promote the sustained, healthy and stable development of table tennis. The specific measures are given in the paper: expand the national ball influence by relying on Chinese One Belt and One Road strategy, realize table tennis culture-leading with the carrier of Confucius institute, carry out wolf plan unswervingly to cultivate the sharp wolf, learn the NBA operation mode to make China Table Tennis Super League well run, excavate the value of overseas corps, teach these countries whose table tennis is weak some training methods, drive mass through athletics to attract the general public to participate in table tennis sport.

Key words: *China, table tennis, development*

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COMPETITIVE READINESS OF MALE AND FEMALE TABLE TENNIS ATHLETES OF THE UNIVERSITY OF THE PHILIPPINES: BASIS FOR A PROPOSED INTERVENTION TRAINING PROGRAM

Abstract

The study determined the competitive readiness of male and female table tennis athletes of the University of the Philippines before the 2016 UAAP Inter-collegiate Table Tennis Competition. It answered the following questions: 1. What is the profile of the table tennis varsity athletes, as measured by the CRSTTA (Competitive Readiness Scale for Table Tennis Athletes)? 2. Is there a significant difference between male and female athletes? and 3. What training program can be proposed based on the result of the study.

Using descriptive research design, the CRSTTA was administered two (2) weeks before the competition to twenty-two (22) table tennis athletes of the University of the Philippines (14 males and 8 females). The CRSTTA is a 60-item, Likert-type instrument to measure competitive readiness in the areas of mental toughness, coachability, physical readiness, tactical readiness, anxiety management, motivation, attention and concentration, self-confidence, and team sociability.

Results showed that both men and women had high levels of competitive readiness (mean=2.94, SD=0.89 and mean=2.92, SD=0.92). It also showed that there is no significant difference between gender in regards to competitive readiness.

Though the results were significant before the start of the competition, this was not enough to compare if the results of the test have significant differences with the outcome of the competition, since the teams only duplicated the final rankings from the previous year. It is highly recommended that a proposed intervention training program be developed to address competitive readiness of table tennis.

Key words: *CRSTTA, competitive readiness, inter-collegiate competition*

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AN ANALYSIS ON SOCIAL VALUE AND FUNCTION OF SPORTS OF TABLE TENNIS IN THE WORLD FROM THE PERSPECTIVES OF EDUCATION, POLITICS, ECONOMY AND CULTURE

Abstract

Through the principia of sociology, this thesis utilizes the of documents and logic analysis to analyse the relationship between table tennis sports and social development in international areas from educational, political, economic and culture perspectives, in the hope of offering some pertinent advice available to the sustainable development of table tennis sports around the world. Analysis shows table tennis has strong educational function, can promote physical and mental health, improve interpersonal communication skills and cooperative ability and cultivate awareness of fair competition. Table tennis also serves a unique political function and has become an important means of international diplomacy. Table tennis has become a sports industry, and it's of great significance to promote the professional and international progress of table tennis clubs across countries. Through the perspective of sports culture preservation, the culture of table tennis is characterized by share ability and nationality. Through estimation from an innovative angle, measures such as increasing the height of net and reforms on competition rules may become the trend of future development in the future of the sports of table tennis.

Key words: *sports of table tennis, sociology, education, politics, economy, culture in the world*

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THE EFFECT OF DETRAINING ON CARDIOVASCULAR RESPONSES IN YOUNG TABLE TENNIS PLAYERS

Abstract

The purpose of this study was to evaluate the effect of the 20-day detraining on cardiovascular responses. Ten (n=10) adolescent players (5 boys & 5 girls), aged 10.8±2.3yrs with body mass 47.5±1.4kg and stature 1.50±1.5cm completed a 10-week Multiball interventional training program and they were reevaluated after a 20-day detraining period (pre-post). Measurements of Maximum Oxygen uptake (VO_{2max}), Lactate concentration (La) and Maximum Heart Rate (HR_{max}) were evaluated during the progressive exercise test to exhaustion on a motorized treadmill (S 2500, Tecmachine, Andrezieux-Boutheon, France). Pulmonary gas exchange and ventilation was recorded by means of Filmate Pro spirometer (Cosmed, Rome, Italy). The Anova analysis of variance with two repeated factors (group & measurements) and Bonferroni post hoc test were applied in order to compare the effect of different protocols on the players' performance. The statistical significance was defined at 5% ($p<0.05$). It was derived from the results that the abstention from table-tennis training causes a decline in the players' VO_{2max} (mean pre: 47.4 ± 2.64ml.min.kg^{-1} - post: 43.4 ± 2.45ml.min.kg^{-1}). Also a tendency for value restoration of La (mean pre: 8.06 ± 1.07mmol.l^{-1} - post: 7.83± .964mmol.l^{-1}) and HR_{max} (mean pre: 203± 2.79b.min^{-1} - post: 202± 2.52b.min^{-1}) to the original ones was observed. Conclusively, the Multiball training method can cause noticeable adaptations to the physiological abilities of adolescence table-tennis players which are maintained after a 20-day interruption of the training procedures.

Key words: *VO_{2max}, mutliball training, detraining*

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FACTOR STRUCTURE OF MORPHOLOGICAL AND MOTOR CHARACTERISTICS OF YOUNG TABLE TENNIS PLAYERS

Abstract

The aim of this study was to determine the latent structure of morphological characteristics and motor abilities of young table tennis players (N=101) aged 9–11 years. This entailed 15 standard anthropometric measures being used to assess four latent morphological dimensions: longitudinal dimensionality, transversal dimensionality of the body, volume and body mass as well as subcutaneous adipose tissue. The selected measurements evenly reflect the International Biological Programme's existing model of the morphological space. To evaluate motor abilities, 24 tests were used which best define latent dimensions: coordination, agility, frequency of movement, flexibility, explosive strength, speed, repetitive strength and endurance. Factor analysis was applied according to the method of principal components, the selection of eigenvalues by the Kaiser criterion and an orthogonal (varimax) rotation matrix of factor loadings. The obtained results indicate that in the morphological space of young table tennis players two factors were extracted: factor of skeletal dimensionality and adipose body volume factor. In the motor space, six factors were isolated: agility factor, explosive strength and frequency of movement factor, factor of the whole body coordination, factor of the shoulder and hip flexibility, repetitive strength factor and flexibility of the lower extremities factor. The obtained results will enable trainers to more objectively direct the long-term development of young players, especially for developing specific motor abilities in sensitive phases.

Key words: *table tennis players, morphological characteristics, motor abilities, factor analysis*

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THE EFFECT OF ISOTONIC RESISTANCE TRAINING ON INTERLEUKIN 6 IN FEMALE TABLE TENNIS PLAYERS

Abstract

The aim of present study was to investigate the effect of isotonic resistance training on Interleukin 6 in female table tennis players.

In this study, 20 female table tennis player (Age: 22/3±2), (Body Mass Index: 22/4± 1/35 kg.m-2) were randomly selected and divided in two groups; 10 subjects in resistance training group (RT) and 10 subjects in control group(CG). All the athletes completed the physical fitness test and 1RM was taken before, in the middle, and after the resistance training. RT group exercised protocol three times per week for eight weeks. The protocol included 7 stations and the training volume was to be carried out exceedingly (80% .85%.90%.95%1RM). After 24 hours, a blood test was taken. In pre and post protocols, white blood cells (WBC), IL-6, was collected and measured using Elisa. In order to indicate the normal distribution of data, the Colmogroph-Smirnoph test was applied. Single and pair t-test were used to determine possible internal and external changes before and after the exercise protocol. ($p<0.05$). The results revealed a significant decrease in the rest levels of IL6 ($p=0.006$). A significant decrease was also observed in the number of WBC ($p=0.041$) after 8 weeks of isotonic resistance training.

These results suggest that regular exercising can be a critical point to reduce systematic inflammation and the related markers such as IL-6. Isotonic resistance training can be a key factor to reduce the IL6 and the related inflammatory markers. This is one of the useful adaptations resulting from this type of training.

Key words: *IL-6, RT, female table tennis players*

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FACTORS ASSOCIATED WITH GOOD FOOD AWARENESS AND BEHAVIORS IN JAPANESE CADET TABLE TENNIS PLAYERS

Abstract

Background: The purpose of this study was to elucidate the factors associated with good food awareness and behaviors in Japanese cadet table tennis prayers. ***Methods:*** Subjects were 96 cadet table tennis players who participated in the JTTA training camp held in 2016. We conducted the survey about the eating pattern, eating habit, food attitude, food preference, stage of food behavior, self-efficacy of eating and life style and nutrition related-physical condition in the training camp. ***Results:*** Our results revealed that 1) although about 80% of subjects were picky about food, the players with stronger food awareness had the habit to finish all the dishes served for them without remaining. 2) The portion size of vegetable side dishes was significantly correlated with the stage of food behavior ($r = 0.434$, $p<0.001$), suggesting that intakes of vegetables may be a good indicator of food behavior in cadet table tennis players. 3) The players, who were able to take well-balanced diet, showed good physical conditions. 4) The players, who had higher degree of motivation to be an Olympic medalist, had good food awareness. ***Conclusion:*** Our results suggest that elevating motivation to be a good player may be an effective strategy to raise food awareness and strengthen food behavior in Japanese cadet table tennis players.

Key words: *stage of food behavior, food attitude, cadet table tennis players*

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THEORETICAL AND PRACTICAL KNOWLEDGE FOR TABLE TENNIS COACHES DEVELOPMENT IN A SPORTS SCIENCE BACHELOR'S DEGREE

Abstract

In Brazil, a professional title Bachelor of Sports Science/Physical Education is mandatory to table tennis coaches work professionally. However, these Undergraduate courses have not been focused on coaches' specific competences. Additionally, the curriculum presents few of coaching practice, which is fundamental to the coaches' development. This study aims to describe an extra-curriculum programme for table tennis coaching practice during a Sports Science Bachelor's Degree. We describe the contributions of the programme for table tennis coaches' development. The programme comprising a total of 30 classes (45 h) during 4 months, and was focused on nonlinear pedagogy. It was based on bottom-up approach, which eight undergraduate students designed the classes/training activities and they were supervised weekly by three professors (PhD) of different knowledge areas. The students were encouraged to propose the training activities based on scientific evidences, and to develop research proposals from this coaching practice. These supervision meetings were thus important to students integrate theoretical and practical knowledge. We observed the students had difficulties to develop their initial classes/training, which was minimized throughout the programme. Thus, they were able to design a session focused on athlete`s competences and games (not on drills); communicate with athletes via questioning, not showing or telling them what to do; and reflect about their own coaching skills. Table tennis coaches need to master a range of expertise in different areas, and some of these are acquired from coaching practice. The proposed programme contributed for table tennis coaches' development in a Sports Science Bachelor's Degree in Brazil.

Key words: *coach, table tennis, nonlinear pedagogy*

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RESEARCH ON TECHNIQUES AND TACTICS OF DIFFERENT GRIP TYPES USED BY TABLE TENNIS PLAYERS

Abstract

This study is aimed at the techniques and tactics of different grip types used by table tennis players. This study takes 5 athletes using pen-hold backhand and 5 using shaker-hand in World Table Tennis Championships and China Open from 2013 to 2016 with observational method to do technique data entry. According to SPSS statistics, the result indicates: 1. athletes using shaker-hand have both higher scoring rate and accuracy in attack after serving than athletes using pen-hold backhand have; each grip type achieves great and good index on scoring rate and utilization rate in attack after receiving ; however, athletes using pen-hold backhand have higher scoring rate in stalemate than who used shaker-hand but each athlete all failed on utilization rate; 2. different grip types and scoring rate in three-stage skill have no significant difference; 3. grip type does not affect outcome and three-stage skill.

Key words: *techniques and tactics, pen-hold backhand, three-stage skill, scoring rate*

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THE COMPARISON OF AROUSAL, ANXIETY AND SELF-CONFIDENCE BETWEEN IRANIAN WOMEN AND MEN ELITE TABLE TENNIS PLAYERS

Abstract

This study was conducted to compare the arousal, self-confidence, somatic and cognitive anxiety among Iranian elite male and female table tennis players. The subjects were 40 elite table tennis players (20 men and 20 women, mean age of 22.90 ±4.90 years) who participated in 2016 national qualifying competitions. Arousal and cognitive anxiety levels were measured by "Sport Grid-Revised" (Ward & Cox, 2004), self-confidence and somatic anxiety were measured by two items of the Mental Readiness Form (MRF-3; Krane, 1994), 10 minutes before the scheduled time of the match. Independent sample t-test was used for data analysis. In comparing women with men, results showed that women arousal level was significantly higher and their somatic anxiety was significantly lower than that of men, but there were no significant difference between their self-confidence and cognitive anxiety. However, in comparison between winning and losing groups the results showed that self-confidence and cognitive anxiety in women and men winning groups were significantly higher than the losing groups. These findings demonstrated there were gender-based differences in arousal and somatic anxiety of elite table tennis players before the start of the match, but self-confidence and cognitive anxiety were effective psychological variables on performance during the match.

Key words: *table tennis, gender, arousal, anxiety, self-confidence*

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ABOUT THE IMPORTANCE OF "SITUATIONAL TRAINING" IN HIGH PERFORMANCE TABLE TENNIS – EMPIRICAL STUDY AIMING TO IDENTIFY MATCH SITUATIONS

Abstract

Four aims were pursued by this self-developed qualitative, sequential match observation method: 1. To extract typical game situations. 2. To find out which competences distinguish between good and very good international players (WTTC of 1985, 1987, 1989). 3. To find psychological reasons for inappropriate situational assessments. 4. To get new information about the inner structure of rallies including the origins of mistakes and points. Diverse work was done in advance, like defining typical game situations of rallies based on psychological research and developing a new appropriate observation method. Based on four preliminary studies, five basic conditions or values could be defined with regard to the effect of a shot (numbers in brackets: numerical code providing calculations of all single (4312 shots in total) and combined events): "mistake" (0), "disadvantage" (2), "stalemate" (5), "advantage" (7) and "direct point" (1). Every rally can hence be seen as a chain of interdependent values (psychological perception and assessment) like e.g. 5 (service) – 2 – 7 – 2 – 1. This leads to the idea of 15 pairs of combinations /situations between two ball contacts, e.g. 5 – 2; 7 - 5 and four main situations that include these 15 pairs: situations of 1. decision, 2. change, 3. preliminary decision and 4. stalemate (3. and 4. with flexible length). Observers were trained to assess the values. To compare the effectiveness of different players` actions, a calculation model was developed. **Results** (selection): 1. The quality of the return distinguishes best between good and very good players. 2. Very good players reach significantly higher efficiency in dealing with a stalemate value of their opponents than good players. 3. Even international top players seem to be influenced by psychological misinterpretations of game situations.

Key words: *systematic match analysis, match situations, tactics, psychology*

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TRAINING LOAD AND INJURY INCIDENCE IN YOUTH TABLE TENNIS PLAYERS

Abstract

Despite the wealth of research documenting the training-injury relationship in elite sport, there is a lack of research and evidence linking training load and injury in junior table tennis athletes. Therefore, the purpose of this study was to analyse and report the training load and the injury incidence over a season in highly trained youth table tennis athletes.

Injury data and training loads were collected from eight male adolescent table tennis players [age (mean ± SD) 14.5 ± 1.4yr, stature 166.7 ± 6.6cm and body mass 53.6 ± 7.9 kg] of Arabic origin in this one-year prospective study. The total training time over the observed 12 months period was 237h 42min ± 44h 30min and the total games played were 35 ± 23 games.

A total of 17 injuries were identified, of which 9 (53%) were time-loss and over-use injuries. The overall injury incidence was 8.3 (95%CI: 4.6–12.0), time-loss injuries was 4.4 (95%CI: 1.9–6.9), growth conditions was 2.0 (95%CI: 0.6–3.3) per 1000h of exposure. Edwards training loads were significantly different between training weeks ($P = 0.001$), with training loads lowest around competition period ($P < 0.05$). The majority of injuries occurred during the 1st quarter of the year (65%), when training loads were significantly higher.

In conclusion, the results of this preliminary study showed that training loads increase during a season until competition period. The rate of overuse injuries and injuries as a result growth-related conditions in our adolescent athletes was higher than previously reported in adolescents in other sports.

Key words: *Racquet sport; Training monitoring; Performance; Injury incidence; Training Load*

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ANALYSIS OF TECHNIQUE AND TACTIC FEATURE OF CHINESE EXCELLENT FEMALE TABLE TENNIS PLAYER - LIU SHIWEN

Abstract

Introduction: This paper took Liu Shiwen, a key player of China, as the example to analyze the scoring rate and usage on her backhanded speed loop. It summarized the features and disadvantages of her backhand's technique and tactic in order to provide some reference for training and competition in the future.

Methods: Logical analysis, video observation, mathematical statistics, literature review were used in this paper. Nine matches from Japan Open and South Korea Open, two back-to-back tournaments, in 2016 were analyzed of Liu Shiwen.

Results: Among nine matches, backhanded down-spin speed loop was the most-used techniques. Direct score rate is higher than indirect score rate. In serving round, Liu always served to opponent's forehand, spin or not, sometimes to middle way with cross half long side-spin shot, then attacked with backhanded speed loop. Generally, those falling points were in opponent's middle way and wide-angle of backhand. In the consistency of backhanded speed loop, Liu always attacked the left and suppressed the right. In receiving round, Liu returned the ball to two wide angles with backhanded speed loop rapidly when she handled the cross half long or long shot. If the ball were short, Liu returned a drop shot to middle short as a transition, or pushed to opponent's backhand as preparation for next attack.

Conclusions and Suggestions: Liu Shiwen has advantages of close-to-table fast attack and high-speed return. Her backhand speed loop is powerful enough, sideways attack should be practiced more. The consistency after backhanded attack was not stable. And re-attack after receiving should be practiced more.

Key words: *table tennis, Liu Shiwen, technique and tactic*

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THE COMPARATIVE RESEARCH ON THE FEATURES OF MATCH AND TRAINING FOR MAIN PLAYERS OF CHINA TABLE TENNIS FEMALE TEAM — BASED ON CELLULOID AND PLASTIC BALLS

Abstract

The ITTF passed the resolution that plastic balls would be used at all world title and ITTF sanctioned events from 1st July 2014 before Paris world championships, 2013. From subjective and objective reflection of Chinese national team players and coaches, this small adjustment has made significant changes on technique and tactic.

The paper analysed the statistics of matches and training for five main players of China table tennis female team (Li Xiaoxia, Ding Ning, Liu Shiwen, Zhu Yuling, Chen Meng), which playing with celluloid and plastic balls in RIO Olympic period from January 2013 to May 2016. 132 matches were randomly chosen from world important tournaments while 917 training data were from closed trainings preparation for world major events. All the opponents were limited in world top 35 based on the world ranking in June 2016. All the training partners were Chinese table tennis female players.

Through using five phases' evaluation method and analysis of variance, this research made 3 kinds of comparative analysis: Matches analysis between celluloid and plastic balls, training analysis between celluloid and plastic balls, performance differences analysis between matches and training with celluloid and plastic balls.

Conclusions as follows: (1) The phases of attack after serve, attack after receive still were the wining factors of China table tennis female team, which always kept high scoring rate and usage in tournaments; (2) The rally length of each point with plastic balls became shorter than celluloid, and appeared a tendency towards the first forth strokes from long rally. (3) The performance diversity between matches and training with plastic balls was smaller than celluloid, players performed more stable.

Key Word: *table tennis, technique and tactic, celluloid ball, plastic ball*

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BOUND POSITION AND HITTING TIME ESTIMATION BY USING MICROPHONES EQUIPPED AT A TABLE IN TABLE TENNIS

Abstract

In table tennis, the bound positions of a ball on the table, the number of shots played per rally that is the sum of a correct service and correct returns are the major concerns of coaches and players. Therefore, a simple method for collecting these quantitative data is required. In this study, we propose a method to estimate the bound position of a table tennis ball and hitting time by using microphones equipped at a table. We put eight microphones on the underside of the table. The microphone is placed at the corner of each court of the table. We also use a camera equipped on the ceiling in order to estimate the trajectory of the ball on the table.

The size of the ball is 40mm, and the resonant frequency is about 8600Hz. Therefore, we extract the sound component of the ball bounds by filtering the sound with 8400-8800 pass frequency band. Then, we estimate the onsets of the sound and calculate the time differences of arrival. The ball bound position can be calculated by a simple sound localization technique. The sound of the ball bounds is coming not only from the table equipped with microphones but also from neighbouring tables. We can ignore other sounds by evaluating the location of the sound.

We can also estimate the time when the player hits the ball. Using the sequence of hitting time, we can obtain the duration between hits. These data are also useful for the analysis of the game.

Key words: *bound position estimation, sound localization, hitting time estimation*

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ANALYSIS OF THE SUCCESSFUL EXPERIENCE OF CHINA TABLE TENNIS TEAM FROM THE VICTORY OF RIO OLYMPIC GAMES IN 2016

Abstract

Since the first participation in the Olympic Games in 1988, China table tennis team has taken the crown numerous times in various international tournaments. In the Rio Olympic Games in 2016, this team even swept all gold medals of the four table tennis items. The success of Chinese team is not accidental. Up to now, learning from the experience of China table tennis team has become a significant way for many other foreign table tennis teams to improve their competitiveness. Methods: Literature review, interviewing, questionnaire and induction. Results: The successful experience of China table tennis team could summed up in the following 10 aspects: 1. Whole-nation system (great support from governments of all levels); 2. The operation pattern of China table tennis team (compound team and high attention to the team power); 3. Coach team construction (professional proficiency, professional quality, intrinsic culture, etc.); 4. Athlete training pattern (selection mechanism and competition mechanism); 5. Athlete echelon construction (Sound training institutions and comprehensive talent network); 6. Coach management mechanism; 7. Athlete management mechanism; 8. Innovative spirit (endless innovation in table tennis skills, equipment, etc.); 9. Long-term goal; 10. Excellent traditional culture (Strong sense of urgency, pay high attention to details, and the spirit of fighting, etc.).

Key words: *China table tennis team, successful experience*

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ANALYSIS OF ANTHROPOMETRIC MODIFICATIONS IN YOUNG PLAYERS DERIVED FROM PRACTISING TABLE TENNIS

Abstract

The purpose of this study is to evaluate how the measured anthropometric characteristics evolved in young table tennis players as a consequence of a specific training regime. 41 players took part in this study (12 female and 29 male) all of whom underwent control and evaluation for a period of four years (between the ages of 9 and 12). Anthropometric evaluation was conducted following the International Society for The Advancement of Kinanthropometry protocol. Data collected for body variables were: weight, height, BMI, skinfolds (biceps, triceps, subscapular, supraspinale, iliac crest, mid thigh and calf), perimeters (contracted/relaxed arm an leg), diameters (humerus, styloid and bicondyle of femur). Body composition was calculated using percentage of body fat, bone and mass percentage, following De Rose and Guimaraes' tetracompartmental model. Carter's method was used to obtain somatotype. Consent form was signed by all participants prior to fore-mentioned processes being carried out.

Analysis of variance for repeated measures of a single factor showed statistically significant differences for BMI ($p=0.029$) and for total value of six skin-folds ($p=0.015$), increasing in both cases with age. No statistically significant differences were found in reference to muscle and fat mass percentages.

Total value of six skin-folds and BMI are extremely interesting variables to keep in mind when managing the evolution of an athlete's biotype due to the direct accumulative effect of specific training sessions after several years. Evaluating body composition in young players may be of interest when it comes to managing their progression, maturation and both physical and sports performance.

Key words: *anthropometric characteristics, young, body composition, training*

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A STUDY OF STUDENTS MOTIVATIONS AND FLOW EXPERIENCE ON PARTICIPATING TABLE TENNIS

Abstract

The purpose of this study was to investigate the motivation and the flow experience of students on participating Table Tennis Exercise. The objects were university students who select table tennis as their PE interest course form midland of Taiwan. To meet the objective of this study more closely, we use "participatory motivation and flow experience scale" as our research tool and utilize descriptive statistics, independent sample T-test, one-way analysis of variance, and Pearson Product-Moment Correlation Coefficient to make statistic calculation and analysis. The results of research are summarized as follows:

1. students who participated in a table tennis class before has a higher motivation to participate in table tennis.
2. Students who had participated in the table tennis competition have higher flow experiences.
3. Students who had the experiences of representing the team had higher flow experiences than those who didn't have experience.
4. Students who participated twice weekly in average have higher motivation then those who participate once a week.
5. There was a high positive correlation between the positive emotions and the voluntary fun in the flow experiences scale.

Key words: *table tennis, participation motivation, exercise flow experience*

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A COMPARATIVE STUDY OF CHINESE AND FOREIGN ELITE MALE TABLE TENNIS PLAYERS' ABILITY TO GRASP "KEY POINTS"

Abstract

Using the method of mathematical statistics and the Simi-Scout technical and tactical analysis software analyses the "key points" in 154 matches and 320 games of the 2011-2016 World Championships, the World Cup, the Olympic Games of the men's singles competitions, this paper presents the results of a comparative study of the seizing ability of "key points" between Chinese and foreign elite male athletes, in order to provide reference for the men's table tennis sports scientific training and competition. Conclusions: 1) Generally speaking, the Chinese outstanding players (Jike Zhang, Long Ma, etc) has a stronger ability to grasp the "key points", compared with the elite players (Dimitrij Ovtcharov, Vladimir Samsonov, etc.) coming from other countries and regions. 2) Specifically speaking, when facing the condition that the "key points" is leading (10:8,11:10, etc.), Chinese excellent players have better ability to grasp the game point than others; when "key points" is divided equally (9:9,10:10, etc.), Chinese outstanding players' ability of creating a leading edge is significantly superior to others; when "key points" is behind (9:10,10:11, etc.), there is no significant difference between Chinese elite players and others in saving the game point. 3) When the score is close in a game, Chinese elite players' ability of winning the game is significantly superior to others. 4) The ability, Seizing the "key points", is really important in high level table tennis competitions. It needs special training.

Key words: *table tennis, key points, competition result, scoring ability*

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RESEARCH ON THE DEVELOPMENTAL DILEMMAS AND COUNTERMEASURES OF CHINESE AND FOREIGN TABLE TENNIS

Abstract

Objective: The balance of Chinese and foreign tennis seriously tilts, the status of table tennis in the Olympic project appear crisis. To further promote the popularization and improvement of comprehensive table tennis, and to guarantee the stable status in the Olympic Games table tennis project, we must stand at the height of the world table tennis development, comprehensively analyze the main contradiction of Chinese and foreign table tennis, find the deep reasons of table tennis sports development objectively and accurately both at home and abroad, and seek the harmonious development of Chinese and foreign table tennis. ***Methods:*** The article uses the literature data method, expert interview method, combined with the three major international table tennis competitions' summary analysis and puts forward the corresponding countermeasures. ***Conclusions:*** the current plight of Chinese and foreign table tennis development: (1) China dominates in the table tennis and the enthusiasm of overseas countries is low. (2) The actual strength gap between the Chinese and foreign table tennis competition is huge, and the ornamental value is insufficient. The enthusiasm of the audience is declining. (3) The three major international table tennis match result lack of suspense, so the table tennis project is faced with serious threat in the Olympic Games. Countermeasures: ITTF should be more effective in organizing, constructive and coordinating, strengthening the competition reform, system reform and equipment hardware innovation; (China) try to establish a global potential youth table tennis player information Database, which can improve the mechanism of table tennis team joint intelligence gathering work and strengthen the table tennis diplomacy strategy; (foreign country) should develop personnel training strategy. We should cultivate table tennis reserved talents in various ways, strengthen the connections between countries, carry out joint training, learn from the experience and expand the cooperation.

Key words: *table tennis, development predicament, countermeasure*

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THE MOBILITY OF SPORTS COMMUNICATION – THE STUDY ABOUT MOBILE NEWS CLIENTS APPLY IN THE TABLE TENNIS TOURNAMENT

Abstract

With the rapid development of communication technology and Internet technology, mobile phone has become one of the most important carriers of information dissemination. Not only it changed the traditional one-way mode of information, but also established the real-time interaction between the information communicator and receiver. It also breaks the limitation of time and space on information transmission, and speeds up the efficiency of information communication. If we conformed to this trend and gave full play to the role of mobile news client in the promotion and broadcast events, changed the traditional model about spread of sports events, finally we would realize the movement of sports communication. This paper was based on an example as the mobile news client in the table tennis competition in communication. We studied the dilemma of mobile news client communication in the table tennis competition. We got the dissemination of accurate communication and content innovation in the communication Mobile News client in the table tennis competition, which will further enhance the tennis event's influence and promote the rapid development of table tennis.

Key words: *sports communication, mobile news client, table tennis tournament, Olympic Games*

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ANTHROPOMETRIC PROFILE OF THE UNIVERSITY OF THE PHILIPPINESTABLE TENNIS STUDENT-ATHLETES: BASIS IN DESIGNING COMPREHENSIVE INTERVENTION PROGRAMS

Abstract

Body Composition is the study of the components of the body and their relative proportions of fat and fat-free tissues. There are several methods in measuring body composition and one of them is Anthropometry, which measures basic, skinfolds, girth, lengths and breadths.

The study determined the Anthropometric Profile of the University of the Philippines Table Tennis student-athletes in order to monitor motor performance through intervention programs on Physical training and nutrition. The researchers are ISAK (International Society for the Advancement of Kinathropometry) certified anthropometrists, which aims to globally standardize the identification of measurement sites and techniques.

There are two common ISAK profiles that are used for anthropometric measurements: the Restricted and Full Profiles, consisting of 17 and 42 measurements respectively. The study is limited to the Restricted Profile which measures somatotype, relative body fat, BMI and waist to hip ratio. Twelve (12) Men and Seven (7) women were selected in the study.

Results showed the predominance of ectomorphic-mesomorph somatotype in men at 41.67%, mesomorphic-endomorph in women at 57.14%. In waist-to-hip ratio, 58.33% have low disease risk related to obesity in men and only 28.57% for women and 57.14% at high risk. For BMI, 83.33% have healthy weight for men and 100% for women. Lastly, 75% have ideal body fat for men and 71.42% have lean body fat for women.

The results indicate adjustments in physical training and nutrition in order to achieve the desired and optimum goal of enhancing performance.

Key words: *anthropometry, somatotype, relative body fat, BMI, waist-to-hip ratio*

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ANALYSIS OF THE DURATION OF RALLY AND REST TIME IN STANDING PARA TABLE TENNIS OFFICIAL TOURNAMENTS

Abstract

The purpose of this was to analyse and compare the match characteristics of standing Para table tennis classes that played in the team tournament at the Rio2016 Paralympics. Eight table tennis matches of each selected class (6, 7 and 8) were analysed. The variables analysed were duration of rally (DR) and rest time (RT). In observing the characteristics of the matches in classes 6, 7 and 8, the DR corresponded to 4.6±1.8, 5.4±2.8, 4.6±1.7 seconds, and RT to 12.4±3.7, 12.6±3.5 and 11.3±3.3 seconds. In the DR of classes 6 and 8 there were no significant differences, but they were found in class 7 between class 6 and 8 ($p < 0.05$). RT in class 6 and 7 found no significant differences, but significant differences in class 8 were observed ($p < 0.05$). The results indicated that the DR time in class 6 was short due to physical limitations, class 8 had greater agility power and class 7 had greater rallies as a result of having more defensive athletes. The RT of class 8 was significantly different compared to classes 6 and 7 due to physical limitations in both classes to catch the ball to start a new rally. These characteristics of Para table tennis should be used by coaches to check the disadvantages of athletes who have more physical limitations when playing team tournaments and plan training prescriptions that aim at achieving better sport performance.

Key words: *para table tennis, standing classes, rally, rest time*

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COMPARATIVE ANALYSIS OF THE TABLE TENNIS PLASTIC BALL AND CELLULOID BALL IN TERMS OF RACKET ANGLE

Abstract

On July 1, 2014, the ITTF started implementing the use of the plastic ball in all ITTF sanctioned and World Title events, instead of the traditional celluloid ball. In addition to the material change from celluloid to plastic, there was also a slight change in the diameter and the weight of the ball from 39.50mm-40.50mm to 40.00mm-40.60 mm and from 2.67g-2.77g to 2.65g-2.82g.

The change in material, together with the change in diameter and weight, can greatly affect the game of table tennis and how it is viewed and played. Since this is a new and recent change and development in the sport, there are still a lot of areas to be looked into and studied.

The purpose of this study was to determine if there is a significant difference between the racket angles among the Philippine Men's Table Tennis National Team Players when using the plastic ball compared with that when using the celluloid ball. A quantitative, experimental, and within subject research design was used in this study. All 3 subjects were tested for both the plastic ball and the celluloid ball and repeated racket angle measurements were taken for all participants.

Results showed that among the group, there was a statistically significant difference between the racket angle measurements for the celluloid ball and plastic ball. Significant differences were also found in each one of the three player's racket angle measurements for the celluloid ball when compared to each one's own individual racket angle measurements for the plastic ball.

Key words: *table tennis, plastic ball, celluloid ball, speed, spin, racket angle, ITTF*

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AN ANALYSIS OF THE TYPE OF PLAY OF THE WORLD'S BEST YOUNG TABLE TENNIS PLAYERS – WORLD JUNIOR TABLE TENNIS CHALLENGE 2016

Abstract

Through literature, expert interviews, game observation, mathematical statistics, comparative analysis and logical analysis, to make the statistics and analysis for 64 elite table tennis players' playing styles who came to Shanghai in 2016 to participate in the World Youth Table Tennis Challenge. The results show that the young athletes in the game technical and tactical consciousness are basically close to the world elite athletes. Loop combination of fast break play occupy the dominant position in this competition, the use of technical and tactical game is relatively mature, high quality of the main features of forehand Middle-long table continuous tension, with strong spin and sharp placement, backhand in the middle court has some breakthrough. It is about stable in attack and defence conversion. Fast break and chop, the two play styles are still not valued by everyone, mainly in the technical and tactical characteristics is not outstanding, in the background of the loop stalemate has become mainstream, there are obvious loopholes in the two styles, it is difficult to have a substantial threat in the game. Most of the players use right hand to take paddle. Athletes played with open grip are significantly more than those played with pen-hold grip. In the game, the ability to control the ball and the ability to adapt is relatively weak. Some players also lack the experience to participate in the contest. They are too conservative on the key ball and always to be indecision.

Key words: *Table tennis; Young athletes; Playing style; Tactics; The status quo*

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THE FRAMING EFFECT ON TACTICAL DECISION MAKING OF HIGH LEVEL TABLE TENNIS PLAYERS UNDER PSYCHOLOGICAL PRESSURE

Abstract

In fierce table tennis game, players are facing with risks in making decisions, and different players will make different decisions under pressure of different scores, whether to adventure or conserve, to change directions of balls or not. Previous study showed that athletes have higher psychological stress in the end stage of games than in the beginning, especially in trailed conditions. This study aims to explore, as for this phenomenon, it is different in the different stages of the beginning and the end of the game or not, whether it is relative to individual's personal traits or not.

We acquired the times and ratio of change of directions(slash to straight, straight to slash) and not change, of the beginning(1-4) and the end(8-end) of 60 games of six high level table tennis athletes (3 males) through analyzing videos. Comparing the beginning and end of games, leading and behind conditions, males and females, to reveal the relationship of psychological state, personal traits and tactical decision, to explore the influence of framing effect on the techniques and tactics of high level table tennis players.

The results showed that: (1) Players intend to change directions of balls more when lagging behind comparing with when in the lead. (2) Athletes change directions of balls more in the beginning of the game, and less in the end. (3) Whether change directions of balls or not is relative to personal traits of players.

Overall, our results suggest that tactical decision making of changing directions of balls is influenced by psychological state in the game, which reflects the existence of framing effect. There are some differences of framing effects between different genders.

Key words: *table tennis, tactical decision making, change of directions, framing effect*

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A METHOD OF ESTIMATING BALL DROP AREA USING AE MEASUREMENT

Abstract

To develop a system that can analyze the hitting area of a table tennis player in real time, we propose a method of estimating the ball drop from the acoustic emission（AE） generated when the ball drops on the table. In previous studies using micro AE sensors, it was established that the ball drop area can be reliably estimated if it is within a radius of 50 mm from the sensor. However, for practical applications, multiple sensors are required that makes the signal processing complicated.

We have comprehensively detected the AE waves generated from a playing table using broadband AE sensors, and proposed a technique for estimating the ball drop area more efficiently. We installed AE sensors at four locations on one side of the playing table. Coordinates were created for 56 points located at intervals of 20 cm from the origin along the *x* and *y* axes. The ball was allowed to drop freely three times from a height of the 16 cm on each coordinate. The AE waves generated from the table were amplified using a preamplifier. The output signal was fed into an oscilloscope, and the peak values of the waveform were recorded.

The AE waves could be detected for a wider range using our experimental setup compared to smaller sensors. Furthermore, the AE waves became larger for ball drop areas closer to the sensor, thereby indicating a possibility of estimating the ball drop area.

Key words: *ball drop area, AE sensor, real time*

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KINEMATIC ANALYSIS OF TOP SPIN FOREHAND WITH CELLULOID AND PLASTIC BALL

Abstract

The top spin forehand (TSF) was always considered the most important and aggressive shot in Table Tennis.

In 2014, the International Table Tennis Federation decided to introduce a new kind of ball, maintaining the same diameter (40 mm) but changing the material used from celluloid to plastic.

The purpose of this study is to compare the kinematic of TSF, comparing the techniques used with the celluloid ball (CB) and the new plastic ball (PB).

Ten male elite athletes were involved in the study (age 22.7 ± 7.4 years, height 177.3 ± 4.4 cm, mass 74.2 ± 10.7 kg). After a warm-up, the athletes were asked to play crosscourt TSF with the same racquet. A Ball machine (Joola Compact) served balls (speed level 7 and freq. level 1) in the forehand corner. The participants performed ten cross TSF with the CB and ten with PB into a target at the opposite side of the table (40x65 cm).

For the kinematic analysis a stereo-photogrammetric system was used (Smart-D, BTS, 10 cameras, 500 Hz) and a total of 44 markers were attached on the athletes' skin. Further markers were attached on the table (four) and on the racquet (five).

Results showed no differences in kinematics variables of upper and lower limbs between TSF performed with CB and PB.

The kinematic variables are angles between (expressed in degrees): shoulders-table (max, impact, and min), shoulder-racquet-table (max and impact), pelvis-table (max, impact, and min), elbow flexion/extension (max, impact, and min), knee flexion/extension (max, impact, and min), and feet-table (mean value).

This study shows that the type of ball has no substantial influence, this suggests that these athletes are able to adapt their technique to varying playing materials.

Key words: *kinematic, technique, top spin*

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NOTATIONAL ANALYSIS IN TOP-LEVEL TABLE TENNIS: A CASE STUDY

Abstract

Notational analysis is a key tool to assess top-level Table Tennis players during competition and training. This study aimed to analyse a selection of technical/tactical indicators during top-level Table Tennis matches.

Eight matches of a top-level Table Tennis player (TTP), played against eight different opponents (OPP) in 2013-2014 international tournaments were randomly selected. A complete set of performance indicators were collected by video analysis: shots, footwork, impact position of the ball on the table and rally outcome.

The shot most used by TTP was topspin (26.4%), followed by service (21.9%), push (19.0%), block (15.0%), top c. top (11%), flick (6.0%) and others (2.0%). When considering forehand (-F) and backhand (-B) shots, TTP preferred to play topspin-F (20.0%), push-F (15.0%), block-B (14.2%), topspin-B (13.5%), and top c. top-F (12.3%). OPP showed similar shot distributions.The distribution of footwork for TTP was: one step (37.0 %), chassè (21.0%), no step (18.0%), crossover (11.2%) and pivot (11.2%), while for OPP the distribution was: one step (37.0%), no step (24.0%), chassè (18.0%), crossover (10.0%) and pivot (6.5%). Concerning the area, TTP received serves mostly in area 3 (54%), 2 (25.0%), and 5 (5.0%), while he served mostly in area 2 (42%), 3 (30.0%), and 5 (17.0%). Finally, winning shots for TTP were topspin-F (39.0%), topspin-B (19.0%), while TTP errors were top spin-F (19.0%), block-B (19.0%), top c. top-F (18.0%).

In conclusion, these findings show how a thorough analytical approach based on notational analysis may be effective for performance assessment of top-level professional players.

Key words: *notational analysis, performance indicators, technique*

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FIFTY YEARS OF TOP-CLASS TABLE TENNIS WORLD RANKING

Abstract

The aim of this study was to analyse of some aspects of the world table tennis rankings in order to better understand the historical and technical evolution of this sport.

One world ranking for every year from 1967 to 2017 was examined by identifying the first 10 male (M) and female (F) players.

For each player the, handedness (left- or right-handed), grip (classic or pen-holder), style of play (offensive or defensive), and nationality, were recorded.

All data are presented as percentages.

Left-handed are overrepresented (M: 25.4; F: 22.6) with respect to the normal population (10-13%).

The classic grip is the most used (M: 72.8; F: 72.5). In M players, a slight increase was observed while in F since 1985 until today the classic grip showed an important increase.

The predominant playing style is offensive (M: 93.4; F: 88.9) with an increasing trend in M and F.

In M the most represented nation is China (39.6) followed by Sweden (12.8), Japan (7.8), Korea (5.1), Germany (4.9), Yugoslavia (4.3).

In F: China (50.4), Japan (8.8), Korea (7.3), PRK (4.6), USSR (3.1), Singapore (2.9), and Hungary (2.4).

In the last 50 years the Asian athletes have dominated the world rankings (M: 56.5; F: 50.4). This domination started in 2003 for M, after a period of substantial balance with Europeans and for F it constantly increases since 1971. Asians are followed by Europeans (M: 43.3; F: 18.8) and Americans (M: 0.2; F: 0.1).

Key words: *table tennis, ranking, handedness*

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STRESS REDUCED THE CAPACITY OF ATTENTION RESPONSES REGULATION OF AMATEUR BUT NOT TABLE TENNIS ATHLETES

Abstract

The ability to cognitively regulate of attention is important for Top table tennis player in the match. Cognitive regulation has been widely shown on their training in the laboratory to be an effective way to alter the incorrect attention responses. We often fail to use these kinds of strategies in fierce competition, abominable environment or other high stress condition. In this research, the visual search processing of table tennis athletes and college undergraduates with different were analysed by ASL software. All participants first learned to practice recognition and table tennis task. Eye movement training directly followed where participants were taught to regulate attention responses to stimulus. Then, participants underwent a 3 min cold pressor stress or a control task before repeating the attack task using these newly acquired regulation skills. Salivary α-amylase and cortisol concentrations were assayed as neuroendocrine markers of stress response. The results showed that professional players fixated particularly on the ball. In the first visual fixation stage, athletes collected more effective visual information. Although there were no group differences in arousal after the initial learning, eye movements of stressed college student participants showed declined attention regulation, which suggest that stress markedly impairs the visual cognitive regulation of new-formed skills affective responses under stress.

Key words: *stress, personality, biomarkers, salivary α-amylase, cortisol, eye movement*

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DEVELOPMENT A COMPUTER PROGRAM FOR SPATIAL-TEMPORAL ANALYSIS OF TABLE TENNIS

Abstract

In table tennis, the spatial-temporal characteristics of a ball seem to have a strong impact on the result of rallies because of its uniquely small playing area. Moreover, research of that may provide practical insights of the human's informational processing. The impact of the spatial-temporal characteristics of a ball, however, has not been clarified sufficiently. One of the most likely reasons why no study could clarify that is the absence of measurement technologies. Although the computer vision technologies have dramatically developed recent days, enormous workload is still required when we measure the movement of a ball in practical scenario, such as matches in a competition. The current study proposes a computer program which computes the 3D translation of a ball. This is the first computer program which can be used for researchers or practitioners to analyse table tennis matches in spatial-temporal aspects without expensive cost. This program consists of 5 functions: intrinsic camera calibration, ball tracking, extrinsic and temporal camera calibration, trajectory reconstruction and spatial-temporal analysis. The key feature of the program is extrinsic and temporal calibration. The program computes temporal offset among cameras and the 3D translation of a ball is accurately computed even if cameras are not synchronized with each other. This feature makes it more usable in practical scenario. Moreover, the program contains all functions required for spatial-temporal analysis of table tennis and many steps of analysis are made automatic. In the presentation, experimental results are shown to demonstrate the usability and accuracy of the program.

Key words: *computer program, spatial-temporal, camera calibration, computer vision*

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UNDERSTANDING HYSTERESIS IN DISCRETE MULTI-ARTICULAR ACTION PERFORMED BY SKILLED AND NOVICE TABLE TENNIS PLAYERS

Abstract

From a dynamical systems perspective, self-organization is a key tenet in understanding human movement and may be examined via phenomenon at the phase transition point. Amongst the phenomenon is *hysteresis*. Hysteresis refers to the influence of previous experience on the next movement pattern. The aim of this study is to examine hysteresis through the investigation of movement patterns in a table tennis task. Skilled (n=10) and novice participants (n=10) were required to return balls delivered in a scaling manner by a feeding machine to nine locations back to a target. 3D kinematic data of the upper body was captured and digitised and results were obtained using the cluster analysis approach. A six point nominal scale was used to record performance. Cluster analysis resulted in two movement patterns for skilled and seven for novices. Hysteresis region for novices were notably larger, spanning over eight locations as compared to the skilled participants' two locations. This highlights the inability of novices in utilising the most suitable task solution at any particular solution and further supports the trait of heightened exploration in less skilled participants. The numerous variations of movement patterns adopted by novices indicates their exploration for the most suitable task solution and infers the presence of meta-stability and degeneracy expected from a discrete multi-articular task. Results for hysteresis indicate that this phenomenon may be a function of skill levels therefore, it may be used as a tool to dichotomise skill levels. In that regard, coaches should adopt training sessions that encourages players to practice a variety of spatial locations that may improve their decision-making skills.

Key words: *hysteresis, dynamical systems*

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MATCH CHARACTERISTICS OF PROFESSIONAL EUROPEAN MALE TABLE TENNIS PLAYERS

Abstract

The purpose of this study was to investigate the match characteristics of professional male table tennis players considering analyses of men's singles competition at the 2015 European Games held in Baku

Methods: Forty five players which were competing in Men's individual event at EG 2015 in 46 matches were analysed. Match characteristics were also analysed according of the phase of competition (from the 1st round to final) and considering the performance level of players. Performance indicators were: played points, games, set and match duration, the number of strokes in point (average and longest rallies). From these observations, the proportion of match time spent in play (effective playing time of whole match and sets) was determined. For all indicators descriptive statistical parameters were calculated, while differences according phase of competition and performance level of players were analysed using one-way ANOVA ($p<0.05$).

Results: Players played average 101.07±22.34 points per game (best of seven) and 18.2±1.00 points per set. Points in the game and sets were increasing during the playing from stage to stage. Mean strokes per point (rally) was 4.76±1.64, and longest rallies in games were 9.37±3.75. Total match time in competition was 35.0±6.1 min (in range, from 28.0-46.0 min) and it was increased from stage to stage. Duration of played set was 6.07±0.7 min (4.8-7.7 min). In all analysed performance indicators according of the phase of competition statistically significant differences were noted ($p<0.05$).

These results provide original information about the match characteristics which can be used in modelling of the training process.

Key words: *table tennis, competition, activity analyses, notational analyses, player performance*

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BLOOD PRESSURE RESPONSE TO EXERCISE IN TABLE TENNIS VARSITY ATHLETES

Abstract

The aim of the study was to examine changes in blood pressure during exercise and to identify blood pressure abnormalities in female and male table tennis collegiate players. Twenty-one athletes (female=8, male=13) completed the Queens College Step Test to determine their response to exercise. Systolic (SBP) and diastolic blood (DBP) pressure markers were measured before, immediately after, and 1, 2, 3-minute post (recovery) exercise. On average, SBP of female and male athletes significantly change after exercise but no significant differences were found between genders on all blood pressure variables. However, individual results revealed 48% of the players had SBPmax of < 140mmHg and one player has DBPmax of > 100mmHg suggesting blood pressure abnormalities. The findings support a similar study in Filipino collegiate racket sport players that showed evidence of irregular systolic and diastolic blood pressure responses to exercise. The current study provides further insights about the importance of exercise blood pressure markers to diagnose athletes at risk of developing hypertension or cardiovascular disease and to evaluate players' metabolic fitness. However, more research is needed particularly which blood pressure parameter would noticeably detect exaggerated blood pressure response to exercise in athletes.

Key words: *hypertension in athletes, abnormal blood pressure, Filipino athletes*

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PERTURBATION INDUCED TASKS TO DICHOTOMISE SKILL LEVELS

Abstract

From a dynamical systems perspective, expert performance is characterized by reproducible low-dimensional patterns of behaviour, which is both functional and consistent as well as resistant to perturbation. From this perspective, the *critical slowing down (CSD)*, may be investigated to unravel the ability of skilled participants. CSD may be determined by calculating the number of trials it takes for a participant to return to the pre-perturbed state after the onset of a perturbation. The aim of this study is to examine CSD through the investigation of movement patterns via a perturbation induced table tennis task. The perturbation induced was in the form of a high topspin. Skilled (n=10) participants (n=10) were required to return a series of balls delivered by a feeding machine to a target. 3D kinematic data of the upper body was captured and digitised and results were obtained using the cluster analysis approach. Results showed that eight skilled participants were unperturbed (i.e. no change in movement pattern after perturbation) throughout the session, as compare to three novice participants. Additionally, the novice participants scored a higher total CSD as compared to the skilled. Finally, a one-way ANOVA was conducted to test for mean CSD differences among the two skill groups. There were significant differences between the two skill groups against the mean CSD at the $p<.05$ level [$F(1, 198) = 9.82$, $p = .02$, partial $\eta 2 = .22$]. In sum, if the concept of CSD is applied to a test/assessment setting, it may be possible to dichotomise skill levels and such information would be useful to a coach or a physical educator to identify the weaker learners and provide the necessary intervention. Conversely, it may also be used to identify the better performers and higher-order training may be appropriately designed.

Key words: *critical slowing down, perturbation, dynamical systems*

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THE EFFECTS OF SOCIAL LOAFING ON TABLE TENNIS: THE MODERATING EFFECT OF PEER LEADERSHIP AND SPORT CONFIDENCE

Abstract

In the learning environment of sport settings, young athlete's interaction produces learning outcomes, personality, and psychological development, and it play a key role. Therefore, the purpose of this study was to explore the effects of social loafing on the forehand spin performance for table tennis, and examined the moderating effect of peer leadership and sport confidence. Fifty young athletes were recruited from five high schools in Taipei. The participants completed Peer Leadership Scale, Sports Confidence Scale, and the Sport Forehand Spin Performance of Table Tennis. The methodological design consisted of four experimental groups. Individual performances were compared in individual versus group conditions. During a first session, participants carried out forehand spin of table tennis in the individual condition. During a second session, one of the four experimental groups was equivalent to a group condition without inter-group competition, whereas the three others competed against fictitious opponents which had same or different levels of group performance. Prior to the second forehand spin of table tennis session, members of the three experimental groups were individually asked to assess their team score as well as that of their opponent. A Two-way Mixed Design ANOVA was used to analyze in study. Two ANOVAs with repeated measures and Scheffé post hoc comparisons were used to analyze in study. The results indicated that, under identifiability conditions, the participants improved their forehand spin performance on table tennis, peer leadership and sport confidence were affected as a moderating role, and they perceived less social loafing in their teammates. This study shows that the competitive context, social interaction, and confidence for group outcomes have an impact on social loafing.

Key words: *loafing, peers, confidence, perceived, performance*

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THE EFFECT OF RULES REFORM ON THE TECHNIQUES AND TACTICS OF TABLE TENNIS

Abstract

Since the beginning of this century, International Table Tennis Federation had amended the rules of table tennis for many times from aspects of the development and promotion of table tennis, including:40mm ball, unblocked service, 11 point system, inorganic glue, new material of pingpong, off-site guidance and so on. The match performance, techniques and tactics were comparative studied between the 100 game videos of the main international competitions before 2015 and that after 2015. The results showed that: 1.The rules reforms made the table tennis more suited to TV relaying, effectively increased the feasibility of table tennis marketing operation, and attracted more funds investment with the combination of game spot demonstration and high technology. 2. The average rallies of each match were increased obviously by the rules reforms, which effectively increase the appreciation of table tennis matches. 3.The rules reform reduced the advantage of the serving round while increased the advantage of the receiving round, which suggested that the training of the receive and attack stage, conversion of attack and defences during the stage of rallies stage should be paid more attention. 4. Athlete could receive the off-side guidance at any time from coach during rallies with the new rules, which made the coordination and comminution between athlete and coach more important.

Key words: *table tennis reform, rules changes, technique and tactics*

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THE IMPACT OF AN EYE-HAND COORDINATION INTERVENTION ON THE DOMINANT HAND IN EXPERIENCED TABLE TENNIS PLAYERS

Abstract

***Introduction*:** There are limited approaches focusing specifically on Eye-Hand Coordination (EHC) training as part of a sport performance enhancement programme. Focus on training the eye–hand visuo-motor system may impact upon key visual and performance characteristics. The present study assessed an eight-week progressive EHC intervention using a Sport Vision Trainer (SVT™). ***Method*:** Seventeen experienced male club table tennis players (Training Group: TG), and a Control Group (CG) consisting of fifteen age-matched participants with no prior experience of the sport participated. The TG underwent eight weeks of eye-hand training using the SVT™ to simulate the coordination demands of dominant racquet hand in the sport, whilst a table tennis standardised evaluative test assessed performance. Measures of visual function and motor performance were obtained immediately pre and post training. Eight weeks of training consisted of three x 20min sessions per week. Random practice sequences simulating rally variations in table tennis were administered, with progressive increases in difficulty. ***Results*:** Controlling for baseline performance, ANCOVA revealed that TG post-task EHC performance and visual search (VS) speed was significantly faster (p<0.05) than CG, whereas post-task VS accuracy was unaffected. A paired samples t-test showed a significantly improved sport specific performance test following the intervention for the TG (mean difference, 9.97 successful returns) (p = 0.001). ***Conclusion*:** The improved TG EHC, and visual search speed showed positive impact upon both the EHC task and to underlying cognitive functions. Training the eye–hand visuo-motor system for the dominant racquet hand can improve EHC performance in table tennis.

Key words: *table tennis, skill acquisition, general vision training, isolated skills, motor control*

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TABLE TENNIS PREVALENCE IN PRIMARY SCHOOLS OF ZARAGOZA (SPAIN)

Abstract

The aim of this study was to investigate Table Tennis (TT) prevalence as part of physical education in primary school (6-12 years).

Correlation design was used with an ex post facto analysis. In order to analyze TT prevalence a no probabilistic population census questionnaire was used for the sample, i.e. 81 teachers (49 male and 32 female). Table Tennis Attitudes Questionaire (TTAQ) was used to collect all data. 13.6% of our simple uses TT as an educational content. Results shown that alternative racket sports (55.6%), badminton (49.4%) and tennis (33.3%) were prevalent in educational content. We hypothesize that teachers tend to use sports in wich they are experts. 11.1% of our sample shown knowledge about TT. Significant differences (p>0.05) were found between gender (X^2=5.980; p=0.14) in terms of TT motivation. More experienced teachers (X^2=25.567; p=0.02) and older ones (X^2=12.74; p=0.04) used TT as an educational content. There is a correlation between neglecting TT benefits and accentuating the barriers to their possible application in school (r=-.419, p=.003). In general, teachers consider TT as a beneficial content during physical activity classes, although the main barrier is a lack of specific material at schools. In conclusion, TT has a low incidence as an educational content in physical activity subject during primary school.

Key words: *table tennis, racquet sports, physical education, primary school*

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ANTHROPOMETRIC CHARACTERISTICS OF TOP-CLASS WORLD AND EUROPEAN MALE TABLE TENNIS PLAYERS

Abstract

The purpose of this study was to compare anthropometric profiles of top 100 ITTF Rank male table tennis players and to set up a set of reference values useful for future investigations on athlete selection, talent identification, and training programme development.

Methods: Seventy-five best world players, ranked in the top 100 at the ITTF Rank list (male) were analysed. The following data were taken: Body high, Body weight, Body mass index, age, Continent affiliation and playing hand. Players were distributed in groups according to performance level. Descriptive statistics parameters were calculated for all analysed players according their performance level. Differences between groups (performance level, Asian and European players, Right-handed vs. left-handed; different age categories) were analysed with One-way ANOVA test ($p<.05$).

Results: Anthropometric characteristics of best World players were: Body high: 180.0±6.8 cm, Body weight: 73.99±7.93 kg, Body mass index: 22.80±1.81 and Age: 29.3±5.6. Asian players have: Body high: 175.0±5.3 cm, Body weight: 68.57±6.49 kg, Body mass index: 22.36±1.84 and Age: 27.4±4.3 and European players: Body high 183.9±5.6 cm, Body weight 76.70±6.5 kg, Body mass index 22.96±1.74 and Age 30.5±6.1 years old.

Results of ANOVA showed that there are no statistical significant differences in anthropometric characteristics according performance level, while that there is in Body high and Body weight between continental affiliations.

These reference data should be useful to practitioners and researchers, providing useful information for talent identification establishing the model of top table tennis player and development for the assessment of training progression in table tennis.

Key words: *table tennis, body weight, body high, body mass index, age*

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THE EFFECT OF GLUCOSE SUPPLEMENTS ON EXERCISE CAPACITY IN TABLE TENNIS PLAYERS

Abstract

Investigations were conducted on three groups of subjects table tennis players at the Olympic Center - Bistrita (n = 5 / group, age = 20.1 ± 0.5 years, G = 69.98 ± 0.3 kg, I = 173.5 ± 5.4 cm). Program effort, with the consent of the subjects, covered, for all lots: two weeks of specific training for 1 hour robot (machine throwing balls) with a frequency of 60 balls / min., with permanent change of directions of throw; robot is used for specific training in table tennis. Loads were studied: group I - control; group II - preload daily glucose, 250 ml of an aqueous solution with a concentration of 30% glucose, 2 hours prior to training; group III - day post-load glucose, 300 ml of an aqueous solution at a concentration of 40% glucose in 2 doses of 150 ml, 30 minutes and 60 minutes after the end of training. Determinations: indirect determination of aerobic capacity, pre- and post-training, 2 weeks after Astrand-Ryhming method; indirect determination of anaerobic exercise capacity, pre- and post-training, 2 weeks after the method used by the Center for Sports Medicine, Bucharest. Conclusions: Administration of glucose supplements to table tennis players train daily causes significant increases in aerobic and anaerobic exercise capacity, which can contribute to increased performance. Glucose supplementation pre- and post-effort, determined to improve predominant aerobic capacity.

Key words: *glucose supplements, exercise capacity, carbohydrate metabolism, table tennis*

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ROLE OF SERVE AND RETURN OF SERVE AT EUROPEAN GAMES 2015 TABLE TENNIS TOURNAMENT

Abstract

The aim of this study was match analyses considering the efficacy of serve and return of serve in high level table tennis.

Methods: The analysis of game was performed using official data from 46 matches played by 45 best European players in Men's singles competition at European Games held in Baku 2015. Performance indicators were: playing on own serve (percentage of won and lost points on own serve) and return of serve (percentage of winning points on opponent serve). All games from 1st round till the final match were analysed (253 sets and 4649 played points). Players were analysed according match outcome (winners/ losers) and performance level (better/lower ranked). For all descriptive statistic parameters were calculated. The differences between winners and losers were analysed with independent samples t-test ($p<.05$), while differences according performance level and according phase of competition were tested using One-way ANOVA ($p<.05$).

Results: Percentage of winners on their serve won point efficacy was 60.60±7.43% (in the range from 47.27 to 83.33%), lost points were 39.37±7.47% (16.17-52.73%) and won points on opponent serve was 53.28±6.73% (40.91-70.97%). Percentage of losers won point on their serve was 46.76±6.67% (29.03-59.09%), lost point's 53.28±6.73% (40.91-70.97%) and won points on opponent serve 39.37±7.48% (16.17-52.73%). Statistically significant differences in efficacy (Winner/Loser) were identified in all analysed performance indicators. There were no significant differences according to the phase of competition and performance level.

This study indicates that these activities can be monitored as a valuable performance indicators, especially in competition and confirm importance for the assessment of training.

Key words: *table tennis, performance analyses, serve, receive of serve*

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A STUDY OF MOTION ABOUT TABLE TENNIS" STEP" AND "CROSS STEP"

Abstract

In order to make efficient shots, table tennis sport needs to apply flexible and agile step movement. It shows the importance of the step under the requirements of short-range and high speed especially using the techniques of "step" and "cross-step" during a game. Therefore, the purpose of this study is to explore the comparison between the side drive and rush attack with "right-side step" and forehand strokes with "cross step". The research method is using push - side flapping test for the six college table tennis athletes. Six college student athletes are testing their speed of step movement and scoring rate for this study by using "step" and "cross step" techniques for each group and each group is continuously testing for ten sets which each set has three balls.

The results showed that there were no significant differences in the speed of movement and the scoring rate between the "step" and "cross step". It's suggested that the coach apply the training of step and need to find out athletes' personal and reasonable step movement for "step" or "cross-step" training, so that the athletes' steps can have better coordination efficiency.

Key words: *step, cross step, table tennis*

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DEVELOPMENT OF A SYSTEM TO ANALYZE THE COURSE PATTERN OF BALL USING SOUND SENSOR IN TABLE TENNIS COMPETITION

Abstract

It is important to analyze the patterns of course distribution of ball objectively as tactics in table tennis competition, especially to obtain the results instantaneously. However, developing a system to analyze such patterns in real time is very difficult because the pitch of the table tennis rally is quite fast. In addition, in order to analyze the distribution pattern, it is necessary to measure the place where the ball bounces on the table. The accuracy of measurement is also important.

In this research, we focused on the fact that the collision sound of the table tennis ball has high frequency. We tried to detect the collision sound using plural ultrasonic sound sensors and estimate the coordinates of the falling point from the difference of the propagation time of the sound wave in real time. We examined this method in the present work.

In order to cover the whole table tennis table, the ultrasonic sound sensor units were set up at three points near the net on each side of the net. The total of units was 6.

The sound wave signal transmitted from each sensor shows the difference in arrival time. This difference was processed by a comparator in multichannel counter, and the falling point was calculated by the trilateration method with CPU in multichannel counter. In this way, we have developed a system to estimate the coordinate position.

The result of dropping the ball to 40 known coordinate points shows that the error with the calculated coordinates was 1.68±1.94cm in the x direction, and 11.04±4.98 cm in the y direction. It is found from this that the coordinates of falling point of the ball can be estimated with sufficient accuracy, and that the system developed in this work serves the analysis of the ball delivery pattern.

Key words: *pattern of course distribution, ultrasonic sound sensor, trilateration method*

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A STUDY ON THE RELATIONSHIP OF INFLUENCE OF ATTITUDE, TRUST, PERCEIVED RISK AND INTENTION OF INVESTMENT IN ONLINE CROWDFUNDING OF TABLE TENNIS ENTHUSIASTS

Abstract

Over the past few years, crowdfunding has become main means of many sports teams and amateur athletes to raise funds for training and registration. The purpose of this study is to understand the table tennis enthusiasts' attitude, trust, perceived risk and intention of investment toward crowdfunding. There are 180 table tennis enthusiasts for the subjects. The statistical methods are factor analysis, correlation analysis and structural equation modelling. The results show that the attitude is directly related to trust, perceived risk and intention of investment, and there is also a direct relationship between trust and intention of investment. However, there is no significant correlation between perceived risk and intention of investment. Therefore, the conclusion is that both attitude and trust are important variable toward intention of investment. Finally, we hope that the study can make it possible for sports teams to get more resources and the necessary sponsorship.

Key words: *crowdfunding platform, intention of investment, sports team*

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EYE-HAND COORDINATION AND EXECUTIVE FUNCTIONS AS DETERMINANTS FOR PERFORMANCE IN ELITE AND NON-ELITE PARA TABLE TENNIS PLAYERS

Abstract

More awareness to the Paralympics resulted in more attention for talent programs and national associations aiming to find high potential para table tennis players. The goal of this study was to explore eye hand coordination and executive functions in elite and non-elite para table tennis players as determinants for performance. The data of 11 elite (age 15-54; 9 male and 2 female) and 11 non-elite para table tennis players (age 13-49; 8 male and 3 female) were analysed in this study. The elite players performed better than the median norms on the Design Fluency and Stroop test (P <0.05). Moreover, the elites significantly outscored the non-elites on the eye hand coordination test (P=0.005) and there was a clear trend that the elites performed better on the executive functioning tests than the non-elites. Finally, the players' competition score correlated highly with the eye hand coordination test (0.861, P <0.001) and low to moderate with the Design Fluency (0.486-0.577, P <0.05) and the Trail Making test (-0.463--0.0706, P <0.05). In contrast, the contrast scores of these tests for switching ability and the Stroop's inhibition scores showed no significant correlation with the competition rating score (P >0.05). The results indicate that both eye hand coordination and the executive functions play a role in the current performance of para table tennis players. Nevertheless, conclusions should be taken with caution due to the sample's heterogeneity. Long-term international cooperation is recommended to better understand the value of these determinants for future successes.

Key words: *sports for persons with disabilities, psychomotor performance, mental processes, aptitude, racquet sports*

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A STUDY ON THE EFFECT OF SERVICE FAILURE, COMPENSATION TOWARD CONSUME AGAIN OF TABLE TENNIS CLUB

Abstract

Table tennis is suitable for all ages and classes, and there are some projects about table tennis in many schools and sports centers, and some table tennis clubs gradually appeared. As it may have some service failure in the service process, the purpose of this study is to understand the correlation of service failure, compensation and willingness to consume again. The subjects are consumers of table tennis club and obtain 143 consumers by convenience Sampling. The statistical methods are factor analysis, correlation analysis and stepwise regression. The results show that there is the positive correlation among service failure, compensation and consume again, and service failure, compensation can predict consume again. Therefore, the conclusion is that table tennis club consumers have willingness to consume again for the service failure and compensation of clubs. Finally, we hope to promote willingness to consume again of table tennis club consumers and assist the club operators of sustainable development through this study.

Key words: *table tennis, service process, sustainable development*

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MOTIVATIONAL CHARACTERISTICS IN RACKET SPORTS – A PILOT STUDY

Abstract

Outstanding performance in individual sports is based on intrinsic motivation. In the last few years, motivation has been evaluated through objective measurement instruments that emphasise knowing an athlete down to their finest details. The evaluation of the motivational characteristics of some groups of athletes is made according to individual sports that are practised. This study investigates 28 athletes, members of their national team, divided into 4 groups (7 athletes from table tennis; 8 athletes from tennis; 6 athletes from judo and 7 athletes from fencing) who were evaluated with the Sport Motivation Scale, SMS 28. Data analysis was performed by comparing the group results with the Kruskal-Wallis and Mann-Whitney post hoc tests. The study results show significant differences between sports at a global level, intrinsic motivation, p = .033 and extrinsic motivation, p =.001. The Mann Whitney post hoc test revealed significant differences between athletes who practised table tennis and judo, external regulation, p =.005, r = 0.52; extrinsic motivation, p =.001, r = 0.55 and athletes who practised fencing, introjection motivation, p = .011, r = 0.46. No significant differences were determined between table tennis and tennis. The results of the analysis of cumulated results from racket sports and other types of sports were non-significant. Racket sports, like table tennis and tennis, have exclusively internal motivation tendencies as opposed to fencing and judo, which on the studied subjects, tend towards external motivation.

Key words: *racket sports, individual sports, motivation*

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EVALUATION OF PHYSIOLOGICAL RESPONSE ON TABLE TENNIS MULTIBALL TRAINING WITH DIFFERENT LOADS

Abstract

Background: There are the three basic energy pathways of the human body, ATP-PC system, lactic acid system, and oxygen system. Table tennis match is mainly in the ATP-PC system. Multiball training has always been one of the major training methods of table tennis, but the intensity has not been determined. ***Purpose:*** Evaluation of physiological response on table tennis multiball training with different loads. ***Method:*** Twelve outstanding male college table tennis players (age 20.42±1.56 years, height 175.33±4.59 cm, and weight71.17±8.64 kg) were recruited in this study. Average training year was 10.33±1.26 years. Method of balance sequence is adopted to test 12 subjects which were required to accomplish 9 balls a repeated (each rep consisted of 9 balls, 1 rep interval 10 sec rest, 9-10), 18-20 and 30-33 training. 1 set consisted of 90 balls, and a total of 180 balls. The frequency was 55 balls pro minute by robot. The test type was the Falkenberg footwork. Lactate (La) level and Heart rate (HR) in baseline (R), during test (1 Set), and end of test at 1, 3, 5 min (E1, E3 and E5) were determined. Ammonia (NH_3) level in R and E5. Rating of perceived exertion (RPE) in R, 1 set and E1. The three tests proceed in an interval of one week. By one-way ANOVA Repeated Measures and LSD used in the Post hoc Comparison, differences in the all dependent variables were analyzed. ***Results:*** In baseline is no difference. 30 balls-33 group exhibited higher heart rate, Ammonia and RPE in post-test immediately compared to the other tests ($p<.05$). The level of lactate in 9-10 group was not over 4 mmol/L lactate threshold at the beginning of test to post-test 5 min and lower than the other group tests ($p<.05$). ***Conclusions:*** The major finding in this study was that the multiball training of table tennis using the Falkenberg footwork test in 9 balls group was reasonable to reflect the energy utilization during competition.

Key words: *lactate threshold, interval time, non-oxygen supply*

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DOES A PERCEPTUO-MOTOR SKILLS ASSESSMENT HAVE ADDED VALUE FOR TALENT DETECTION IN TABLE TENNIS?

Abstract

Talent detection intends to support life-long sporting, reduce drop-outs and sports at the elite level. For this purpose it important to reveal the specific profile which directs children to the sports that connects to their strengths and preferences. This study evaluated a perceptuo-motor skills assessment as part of talent detection for table tennis, since perceptuo-motor skills are considered essential to develop the difficult technical aspects. Primary school children (n = 121) were compared to gifted young table tennis players (n = 146) using the Dutch perceptuo-motor skills assessment measuring both 'ball control' and 'gross motor function'. General Linear Model analyses showed that the table tennis players outperform their primary school peers on the 'ball control' items ($P < 0.001$). The multivariable logistics regression models, including the 'ball control' items and 'sprint' or 'speed while dribbling', classified 88-94% to the correct target group. A discriminant function analysis confirmed the added value by identifying the primary school children (28%) fitting the table tennis' perceptuo-motor profile. In conclusion, the assessment appear to be of added value for talent detection in table tennis at this young age. Longitudinal studies need to reveal the predictive value for sports participation and elite sports.

Key words: *psychomotor performance, aptitude, racquet sports, youth sports, predictive value of test*

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VISUALIZATION OF TABLE TENNIS SKILL BY NEURAL NETWORKS AND FUZZY INFERENCE

Abstract

The Topographic Attentive Mapping (TAM) network is a biologically-inspired classifier that bears similarities to the human visual system. When used in a TAM network, the proposed pruning algorithm improves classification accuracy and allows extracting knowledge as represented by the network structure. Fuzzy Inference is a representation method of mapping inputs to outputs using fuzzy set theory. Fuzzy inference has been successfully applied in fields such as automatic control, data classification, decision analysis, expert systems, and computer vision.

In this paper, sport technique evaluation of motion analysis modelled by TAM network and Fuzzy Inference is discussed. The trajectory pattern of forehand strokes of table tennis players is analyzed with nine sensor markers attached to the right upper arm of players. With the TAM network and Fuzzy Inference, technique rules are extracted by learning algorithm in order to classify the skill level of players of table tennis from the sensor data. In addition, the difference between the elite player, middle level player and beginner is visualized, and how to improve skills specific to table tennis from the view of data analysis is discussed.

Key words: *neural networks, fuzzy inference, skill visualization, table tennis*

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DETERMINANTS FOR TABLE TENNIS PERFORMANCE IN ELITE SCOTTISH YOUTH PLAYERS USING A MULTIDIMENSIONAL APPROACH; A PILOT STUDY

Abstract

Fourteen elite Scottish youth male table tennis players were assessed using a multidimensional profiling model in order to identify determinants of performance. Data on anthropometrics for maturation, perceptuo-motor and psychological skills as well as each players' training history were gathered. Spearman correlation coefficient between the determinants and performance outcomes were calculated. A significant correlation (R = -0.73, *P* = .001) between the age to peak height velocity (APHV) and progression scores (rating 2017 minus rating 2016) was revealed, suggesting that a player pre-APHV was likely to improve their rating by more points than a player post-APHV. This might be explained by the physical maturation an individual experiences, which is supported by the significant correlations found between height (R = -0.72, *P* = .004), weight (R = -0.56, *P* = .039) and the sprint test (R= .63, *P* = .017) with the progression scores. Moreover there was a significant correlation between the number of playing years and the rating in both (2016: R = .84, *P* < .001; 2017: R = .79, *P* = .001). Analysis also suggested a younger starting age benefited ratings, with a significant correlation found between starting age and the 2017 ratings (R = -0.72, *P* = .003). A player will have had more time to practice the longer they have been playing, allowing more time for skill development, competition experience and physical training. Furthermore, as this study included players ranging in ages from 13-17, the players who had been playing for longer were also likely to be older and subsequently more physically mature.

Key words: *aptitude, racquet sports, talent development, predictive value of test*

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DEVELOPMENT OF SYSTEM OF TABLE TENNIS GAME ANALYSIS USING ULTRASONIC SENSOR

Abstract

It is a common perception that reconsideration of games after making statistical analysis based on game records is important for future games. It has been desired in table tennis to get data of every bound of the ball on the table for statistical analysis. However, it is not easy to collect such data, because table tennis is a speedy sport. Several methods have been proposed in previous studies, but not yet in practical use.

In this work, we tried to develop a system and software of recording the bound points by using ultrasonic sensors. This system is called "Ultrasonic Sensor Globe Characteristics Analysis System". The principle of measurement is to make use of difference in arrival time of collision sound waves coming from different sensors set up at different places. The coordinate of the bound point can be calculated from those signals. The reason to use the ultrasonic sensor, not audible sound sensor, is that the collision sound has high frequency and the accuracy of the ultrasonic sensor is superior to that of the audible sound sensor. We developed the software which connects bound coordinates and displays a locus of rally by white lines.

Key words: *pattern of course distribution, ultrasonic sensor, collision sound, coaching*

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A COMPARATIVE STUDY OF THE STATISTICS OF TABLE TENNIS SINGLES MATCHES IN RIO 2016 OLYMPICS

Abstract

The research data collected were the statistical data based on the results of the table tennis games announced on the official website of Olympic Games, commonly known as Rio 2016. The 134 men and women taking part in the singles matches in Rio 2016 were the subjects of this study. The results of the preliminary rounds up to the finals were recorded and the average duration of each match or game, the game margin, the point margin and the average number of strokes per point as well as their occurrence rates were compared and analyzed. The findings are as follows:

1. In terms of game margin in each match, in men's singles, 24 matches ended 4:1, which had the highest occurrence rate (34%). In women's singles, 28 matches ended 4:1, which had the highest occurrence rate (40%). This finding indicates that judging from the high occurrence rate of the game margin of 4:1, neither the men's nor the women's matches were competitive enough.

2. In terms of point margin per game, in men's singles, 131 games had the point margin of 5, which had the highest occurrence rate (36%). In women's singles, 146 games had the point margin of 5 or more, which had the highest occurrence rate (40%). This indicates that judging from the high occurrence rate of games with the point margin of 5 or more, players won most matches hands down in both men's or women's singles. There was little chance for comeback when trailing.

3. In terms of the number of rallies per point, in men's singles, the average was 5. In women's singles, the average was 7. This shows that the women's average number of rallies per point was 2 (40%) greater than the men's and different techniques and tactics were adopted by the male and the female athletes.

Key words: *table tennis, singles matches, 2016 Olympic Games*

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EXPERIMENTAL STUDY ON IMPROVING THE STRIKING EFFECT OF JUVENILE TABLE TENNIS PLAYER'S FOREHAND LOOP BY BARE-HANDED WEIGHT TRAINING

Abstract

Introduction: To cater to the model of "combination of sports and education", our study is performed to compare the effect of bare-handed weight training between juvenile athletes. ***Methods:*** 30 subjects were divided into group A, B and C randomly. Experiment is divided into full topspin training period and continuous backspin drive period during 4 months. Subjects hold a dumbbell and swing 30 times with their eyes closed as group A, the same exercise as group B with their eyes opened, and no weight training as group C. And then subjects are asked to strike the ball as far as possible within a 25cm by 25cm and a 12.5cm by 12.5cm area in front of the end line. Hitting rate, goal number in the square area in front of the end line, speed of striking and heart rate are recorded. ***Results:*** The goal number in the square area in each group has improved and the record of touching net has decreased compared with before. It shows that weight training can improve the arc of ball and increase the depth of the ball; group A and group B has improved significantly compared with group C on the speed of striking, and the averaged heart rate was higher as well. According that the effect of striking improved obviously in group A, researchers conclude that weight training with the eyes closed is the more efficient method to improve the forehand loop technology between juvenile athletes.

Key words: *weight training, loop, the effect of striking, kids training*

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THE EFFECT OF IMPLEMENTING PLASTIC BALL IN CHINESE EXCELLENT FEMALE TABLE TENNIS PLAYERS' TECHNIQUE AND TACTICS PERFORMANCES

Abstract

According to the regulation launched by ITTF (International Table Tennis Federation), the official materials utilized in manufacturing table tennis balls have been changed from celluloid to plastic since 1st of July, 2016. That is to say, from then on, plastic ball has officially emerged on ITTF events. The main purpose of this study aimed to explore the effect of implementing plastic ball in Chinese excellent female table tennis players' technique and tactics performances (i.e. three-part skill performances) during the early transition period (from February 2013 to August 2015). This study had been done with the eyes on 32 games (177 rounds in total) participated by Xiaoxia Li, Ning Ding, Shiwen Liu and Lingyu Zhu, and with the method of video observation, mathematical statistics and comparative analysis. Based on the research, the developing tendency of plastic ball can be anticipated will be better and better. The research results can be concluded as follows. (1) After using plastic ball, there was less effect in serve-then-aggress part while was quite large effect in receive-then-aggress part and there was great effect in rally part. (2) Using plastic ball contributes to serve-then-aggress part that players were easier to attack rivals. (3) The athletes benefited from using plastic ball in receive-then-aggress part that they were more proactive even were capable to change situations from passive to active. (4) When using plastic ball, the rounds that athletes played in rally part were increased so that the competitions would be more eye-catching. According to the conclusion, it could be found that using plastic ball has exactly affected female players' technique and tactics performances (i.e. three-part skill performances). It brought positive effects on Xiaoxia Li, Shiwen Liu and Lingyu Zhu while brought negative effects on Ning Ding.

Key words: table tennis, celluloid and plastic balls, technique and tactics performances

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DIFFERENCES IN PSYCHOLOGICAL SKILLS IN TABLE TENNIS PLAYERS DEPENDING ON SPORT LEVEL

Abstract

The objective of the study was to find out if there are differences in the psychological abilities related to sport performance, according to the level of sport practice (professional vs amateurs, international successes vs no international successes) in table tennis players. The sample consisted of 133 table tennis players from around Spain. In order to measure the psychological abilities of table tennis athletes, the Spanish version of the "*Psychological Characteristics Related to Sport Performance Questionnaire*" (CPRD) was used. The results did not show significant differences ($p>.05$) in mental abilities, which include: stress control, influence of performance evaluation, motivation, mental ability and team cohesion, among professional and amateur table tennis players. On the other hand, no significant differences ($p>.05$) were found in these mental abilities among athletes with and without international success. It was concluded that there are no differences in psychological skills depending on sport practice level of Spanish table tennis players.

Key words: *mental skills, sport performance, racket sport*

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RESEARCH ON THE INTERNATIONAL PROMOTION ROUTE OF TABLE TENNIS – A CASE STUDY OF CTTC

Abstract

Objective: Striving for fully implementation the international promotion plan of table tennis, CTTC has displayed principal devotion to international marketing in recent years, despite multitudinous challenges encountered in the process.

Methods: Taking CTTC as the research object, the paper involves various analysis methods including literature material, expert interview, questionnaire investigation, case study and logical analysis methods.

Result: Basically, four perspectives are expounded regarding the investigation and perception of the international promotion status of CTTC, respectively the overseas training camp, international training, international events and trans-regional cooperative relationship. Subsequently, the logical path of CTTC's international promotion is summarized. As is revealed in the result, CTTC is equipped with international school-running mechanism, proactively "stepping out" and launching international camps: Its European branch institute successfully holds juvenile table tennis training camp in Luxembourg three to four times a year and CTTC are making every effort to make the training camp known to other intercontinental. Besides, CTTC possesses professional training system, successfully organizing over 20 international trainings in the past two years. I myself handed out questionnaires to the Hiroshima middle school team members and conducted interviews. All participants said their awareness and understanding to table tennis had been deepened, but on the intensity of training, 74% of the people said the training is intensive but they could adapt to, while 14% said the training is intensive and they couldn't adapt to. Additionally, CTTC owns high-profile venues, positively holding international youth tournaments. It successfully held the 25th East Asia Hopes Table Tennis Championships and WCC in 2016. Trans-regional cooperation interactive communication platform is established in CTTC, long-term cooperation contract being signed with Luxembourg, Iran and Hong Kong.

Conclusion: To date, great achievement of promotion has been made despite such issues as low development sustainability, restricted popularization scope, limited targeted group and stronger training intensity etc. Constructive proposals are raised including reinforcing the international sports-education combination, dispatching excellent coaching team for long-term teaching service abroad, sponsoring more types of international competitions, intensifying the cultivation of table tennis talents and strengthening scientific research.

Key words: *table tennis, CTTC, international promotion*

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COMPETITION TACTIC APP DEVELOPMENT OF TABLE TENNIS PLAYER

Abstract

Before competition, coaches and players have no other way but depend on experience and opponents' past videos to make strategy which usually has less efficiency because of fierce adversary of tennis table. The research sets the system analysis and function requirement based on literature collation, and develops competition tactic APP for coaches and players: user system function requirement, preliminary interface development, and system setting development finally. Through App developing, the purpose of this research is to help coaches, players and related department record, promote efficiency of recording, maintainability, and delivery, and provide practical suggestion on both pre-competition training scheme and tactics application.

Key words: *competition analysis, APP micro application, tactic strategy, interface*

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FUNDAMENTAL STAGE OF DEVELOPMENT IN TABLE TENNIS (POLISH EXPERIENCE)

Abstract

"FUNdamental stage" was defined as initial and basic stages of development of Primary School children. "The initial stage" was defined as FUNdamentals-1 which can be optimal for 6-8 years old children. "The basic stage" was defined as FUNdamentals-2 which can be optimal for 9-13 years old children. The FUNdamental stage is considered as the most important for learning-teaching table tennis single skills: grips, stance and basic ready positions, footwork steps, attacks, blocks, topspins, pushes, chops, serves, returns and their combinations.

In 2009, Polish TTF prepared report on "the current state of training system in Poland". It was identified there that one of the weakest points was the low-quality training, coaching, and organization of initial and basic stages' usually run as imitating of "seniors' training model".

On the basis of World literature (scientific papers, coaching books, films, documentaries etc.) and own experiences we have been building theoretical model of FUNdamental stage training system including: goals, designing and building teams, cultures, organizations, planning and monitoring training (physical, technical, tactical, mental), competition and recovery. Integral AQAL model was applied to organize all the knowledge. The theoretical model serves as the reference tool for action.

On the basis of the theoretical model in 2009 the program "FUNdamentals, from dream to Mastery in table tennis" for children, coaches, managers, parents etc. was initiated. Until 2017 the program has been growing as constantly improved prototype on small scale including: over 200 whole-day workshops for coaches in 20 cities; over 500 two hours' skype teleseminars; over 150 coaches had finished the program FUNdamentals 1; over 30 coaches had finished FUNdamentals2; over 2000 children participated in the program; almost 1000 children attended over 20 training camps supervised by 100 coaches.

In the process of continuous monitoring observation forms, skill observation charts, match statistical analysis, interviews with participants and experts, testing, questionnaires, after action reviews and other action research principles and tools are used.

The purpose of this paper is (1) the first step of organizing all collected and recorded material and (2) presenting some key conclusions.

Key words: *FUNdamental stage, theoretical model, programs for children and coaches*

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THE STUDY ON THE ORNAMENTAL EFFECT OF THE COLORED PLASTIC TABLE TENNIS

Abstract

In order to increase the ornamental value of the table tennis match, China Table Tennis Association proposed the tentative idea of using coloured plastic ball. The observe effect, velocity, the rotational speed of the coloured plastic ball were experimental tested and analysed by the methods of simulation official matches, CCTV simulation broadcast, questionnaire survey and kinematic test. This study aimed to provide some theoretical basis for the further reform of the table tennis. The results showed that (1) The velocity and rotational speed of the ball decreased significantly after reaching the opponent' table by the celluloid and plastic ball; (2) The coloured ball could improve the ornamental value of the table tennis game. (3) White and orange with black stripes of the ball was the ideal choice.

Key words: *coloured plastic ball, ornamental value, velocity, rotational speed*

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A STUDY ON THE TECHNIQUE AND TACTICS OF WHEELCHAIR TABLE TENNIS MEN'S DOUBLES

Abstract

In this study, four excellent class 4-5 male table tennis players in the wheelchair category in the Rio 2016 Paralympic Games were selected as the subjects. By means of the video observation method, one match was analyzed statistically. The techniques and tactics of these male table tennis players in wheelchairs were analyzed and compared in order to find out some of the characteristics of wheelchair table tennis men's doubles matches. The findings are as follows:

The tactics of this wheelchair doubles match were characterized by closeness of the wheelchair seat to the table, fast pace, a great number of rallies per point, etc. It suggested that when these players are playing doubles, they position their wheelchair seats in a different way, use different techniques and tactics, and choose paddles with different functions.

The total time and rallies in this class TT4-5 match were 40-50% more than those in lower class single and double matches, which indicated higher match intensity. In terms of the three-stage techniques, players used less Serve- Attack and Receive - Attack. They tended to use simpler techniques such as pushes and backhand blocks to control and cope. In addition, more conservative tactics were applied. They did not attack aggressively but more often tried to win the point in the Stalemate stage. Mostly players used pushes and waited for opportunities to attack. Players with less sophisticated techniques or in a lower class got attacked more frequently. This was the tactic of the stronger player attacking the weaker opponent, which is featured in a wheelchair double match.

Key words: *para table tennis, double, wheelchair*

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MOTIVATION DIFFERENCES IN TABLE TENNIS PLAYERS DEPENDING ON AGE

Abstract

The objective of this research was to find out if there is a difference in the competitive motivation of table tennis athletes depending on the age category (senior and veterans, and young table tennis players from 8 to 22 years old). The sample consisted of 133 table tennis players from around Spain. In order to measure the psychological abilities of table tennis athletes, the Spanish version of the "*Psychological Characteristics Related to Sport Performance Questionnaire*" (CPRD) was used. The results showed higher levels of motivation (p<.01) and mental ability (p<.01) in young table tennis players. No differences were found in the other factors, which include: stress control, influence of performance evaluation and team cohesion. Subsequently, the motivation factors were separated, the results showed higher levels of basic motivation in young table tennis players (p<.01) than in senior and veteran athletes. In the other areas (goal setting motivation and daily motivation), no significant differences were found. In addition, linear regression analyses (R^2=.808) showed a relationship between the basic motivation and young table tennis players. It was concluded that the basic motivation is related to young table tennis players and that young table tennis players have higher levels of basic motivation.

Key words: *mental ability, racket sport, motivation, psychological skill*

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THE DISCUSSION HOLD TO CLAP TO SEPARATE'NET TO RESIST THE SPORT TECHNICAL ABILITY IN THE ITEM (TABLE TENNIS, BADMINTON, TENNIS) OF SKILLS MIGRATION

Abstract

Objective: Table tennis, badminton and tennis project has a remarkable characteristic in the game, which the players of the two sides, through the final hit the ball speed, strength, placement, arc, rotation of the five physical factors to achieve. The athlete technology competitive ability is mainly from the hit the ball out of time and space characteristics shown in the game, thus forming an important issue in the study of motor skill learning, namely sports psychology called learning migration. Table tennis, badminton and tennis these three items as the racket net main items and requirements follow the sport between laws and internal relations in the learning process, especially the application of skill transfer theory.

Methods of observation, questionnaire and interview were used.

Results and discussion:

1.The transfer of sports skills in the project of holding the racquet

On table tennis, badminton, tennis movement skill transfer pace; skill transfer in table tennis, badminton and tennis forehand technology projects; skill transfer in table tennis and badminton, tennis backhand technique; table tennis, tennis skill transfer etc. the rebound hammer are analysed.

2.Application of sports skill transfer theory in the teaching and training of table tennis, badminton and tennis

This paper probes into the reasonable arrangement of teaching training sequence, the selection of teaching materials, the rational arrangement of teaching contents, and the improvement of teaching and training methods and so on.

Conclusions:

1.The positive transfer table tennis and badminton, badminton and tennis moves there movement skills, positive transfer and moves between table tennis and badminton skills more, not the existence of skill transfer moves table tennis and tennis.

2.Table tennis, motor skills exist between badminton and tennis forehand technique three projects are migrated, and the skills of table tennis and tennis greater positive transfer between projects.

3.Table tennis and badminton between backhand and badminton and tennis backhand technology are between the positive transfer of certain motor skills, but the transfer amount is not large, and motor skills of table tennis and tennis backhand technique exists negative transfer.

4.Table tennis and tennis skills rebound hammer motion migration, there exists a large positive transfer of skills.

5.Badminton and tennis ball hitting the movement skills, there is a greater positive transfer of skills.

Key words: *table tennis, badminton, tennis; motor skills; positive and negative migration*

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ROC AND DICRIMINANT ANALYSIS CAN PREDICT INJURIES BY THE FUNCTIONAL MOVEMENT SCREEN IN THE CHINESE HIGH-LEVEL TABLE TENNIS ATHLETES

Abstract

Background: The Functional Movement Screen is a comprehensive text that assesses quality of fundamental movement patterns to identify an individual's limitations or asymmetries. Previous research has shown that athletes scoring lower than a 14 were more likely to be injured than those scoring above 14 on the FMS. No studies have implemented the FMS as a screening tool for the elite Chinese table tennis athletes. The Chinese table tennis team is one of the most powerful team in the world. These elite athletes spend much time doing a great deal of practice every day. They often utilize compensatory movement strategies to achieve high performance. These inefficient movement strategies may reinforce poor biomechanical movement patterns.

Purpose: To determine the relationship between the elite Chinese table tennis athletes' score on the FMS and the likelihood of injury risk.

Methods: This research mainly use literature method and the test method do the FMS test for the Chinese junior national man and woman table tennis athletes and the national top youth athletes total 81 athletes before the start of the season. By using the ROC curve graph and discrimination formula to get the relationship between the athletes' score and the likelihood of injury risk

Results: The mean score for the 81 athletes was 13.4±1.5. Male athletes were 13.2±1.5. Female were 13.5±1.5. There was no significant difference between male and female athletes (P=0.347). The elite Chinese table tennis athletes who get the score (<12.5) suffering a potential injury risk probability is about 28.5 times greater than the score of (>12.5) points (with specificity of 0.886 and sensitivity of 0.811; the odds ratio was 28.5). Discriminant analysis screened out four tests closely with injury risk of the elite Chinese table tennis athletes: deep squat, rotary stability, hurdle step, active straight leg raise.

Discussion and Conclusion: Compensatory fundamental movement patterns can predispose the elite Chinese table tennis athletes to injuries. FMS could be used to predict injury in the elite Chinese table tennis athletes. Different from the previous researches, a score of 12.5 or less on the FMS resulted in an about 28.5 times increased in risk injury over the course of a competitive season. Additionally, the results also indicated that the 7 tests in the FMS test are not applicable to all sports and all the people. The significance of each test in different sports and different groups may be different. The injury risk threshold and discriminant analysis can be used to complement each other, as a common method to determine the potential injury risk.

Key words: *relationship, functional movement screen, elite, Chinese table tennis athletes*

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THE INTELLIGENT ANALYSIS SYSTEM FOR TABLE TENNIS TECHNIQUES AND TACTICS AND ITS APPLICATION IN 2016 RIO OLYMPICS

Abstract

1 *Objectives:* As the core to achieve success in table tennis, the techniques and tactics play a very important role in the stability of player's psychology. The coaches and players of China Table Tennis Team attached great importance to the technical and tactic intelligent analysis during 2016 Rio Olympic Games. The research team developed the intelligent analysis software for table tennis techniques and tactics, under the support of Bureau of Science and Education as well as Sport Evens Management Center, State General Administration of Sports. It also conducted the study on the technical and tactic features of elite players in China and abroad, providing the scientific and technological support for China Table Tennis Team to prepare for Rio Olympics.

2 *Research results:*

2.1The intelligent analysis system for table tennis techniques and tactics

Based on the present technical and tactic analysis system, the new analysis methods, including artificial neural network analysis model, Markov chain model and technique efficiency model, were introduced in.

(1) Artificial neural network analysis model

On the basis of 3-layer BP neural network analysis model, the success contribution rate of technical and tactic observation indexes was calculated.

(2) Markov chain model

The transition probability matrix of the game states (such as techniques and tactics) was used to describe a match, and then Markov chain was used to calculate the winning probability and determine the competition efficiency value of the game states. Competition behaviour model, striking technique model, striking place model and placement model was divided in this analysis system.

(3) Technique efficiency model

The utility efficiency of table tennis players is influenced by 2 factors, i.e., scoring rate and utility rate. When the scoring rate is smaller than 50%, the bigger utility rate will produce more active influence on success and vice versa. With this principle, the Technique Efficiency model (TE) for the utility efficiency of table tennis players was built to evaluate the utility efficiency of techniques and tactics of players.

2.2 The Application of Intelligent Analysis System in 2016 Rio Olympics for China Table Tennis Team

In preparing for Rio Olympics, the intelligent analysis system for table tennis techniques and tactics provided China Table Tennis Team abundant scientific and direct analysis reports on the opponents' technical and tactic features abroad, which was highly affirmed by the coaches and players. It also played its huge role in preparation for and during 2016 Rio Olympics.

Key words: *table tennis, intelligent analysis system, techniques and tactics*

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RESEARCH ON THE CURRENT SITUATION AND DEVELOPMENT STRATEGY OF CHINA TABLE TENNIS SUPER LEAGUE

Abstract

Purpose: China Table Tennis Super League has developed more than 20 years, it is one of the most competitive table tennis league in the world. although it has its own unique advantages and accumulates long-term development, but the game operates within various aspects condition also exists many problems, the event organizers have the responsibility and the obligation to build the event more reasonable and attractive through the analysis of rigorous and scientific investigation, this paper is on the purpose of the future theoretical research and provide some useful theoretical reference for the operation of table tennis competitions in the future. ***Methods:*** This paper makes use of the methods of literature analysis, questionnaire survey, data statistics, case study and logical analysis to study the basic situation and problems of China Table Tennis Super League, and put forward the corresponding countermeasures and suggestions. ***Results:*** The analysis of the status quo of the China Table Tennis Super League can include: **(1)** The management of the participating clubs, operating system, echelon construction are different, these differences directly lead to the contradictions between the club and the athletes, and the league must consider the national team's task and provincial team's competition per Olympic year and National Games' year. **(2)** In China, although popularizing rate of table tennis is very high, some related statistics show that, the total population is 1.4 billion, 10 million people often participate in table tennis competitions, 300 million people will play table tennis occasionally, because of the loss of external promotion and publicity work, the audience rating of China Table Tennis Super League is not very high, in 2016, the audience rating is 0.2 or so, up to 0.35, there still exists a gap between the expectation and the reality. **(3)**During the competition period, the funds of the participating clubs are relatively simple and unstable, leading to the cash flow situation, and because the club is not related to the formation of the system and regulations, there are improper operation of the venue, players, coaches income distribution is not uniform, and so on.***Conclusion:***For the future development of the China Table Tennis Super League, these measures can be taken: (1) Deepen the reform of the system, to promote the China Table Tennis Super League more professional.(2) Continue to improve the institutionalization of the club, echelon construction and strengthen the relevant laws and regulations, create the tournament brand unswervingly.(3) Insist on increasing the publicity of the entire league, increasing investment, broadening the publicity channels, and promoting the relevant subsidiary and derivative industry.

Key words: *China table tennis Super League, unique advantages, problems, actual research, methods*

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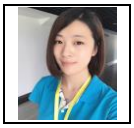
80	**Jiang, Kebing**		bs23@vip.qq.com	Shanghai University of Sport, China	CHN
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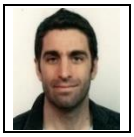
132	**Munivrana, Goran**		goran.munivrana@gmail.com	Faculty of Kinesiology, University of Split, Split, Croatia	CRO
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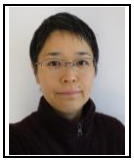
139	**Ooishi, Megumi**		g-1bee64go.62@jcom.home.ne.jp	Sports Science and Medicine Committee, Japan Table Tennis Association, Japan	JPN
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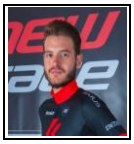
156	**Salvà, Pau**		pausalvamartinez@gmail.com	Faculty of Sports, University of Valencia, Spain	ESP
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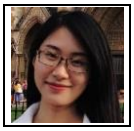
176	**Tang, Xiaohui**		hui.life@163.com	General Education Department, Guangxi Arts University, China	CHN
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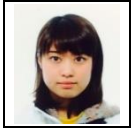
178	**Terada, Yuumi**		p13j632b@yahoo.co.jp	Graduate School of Modern Society and Culture, Niigata University, Japan	JPN
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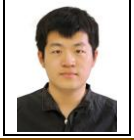
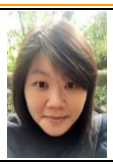
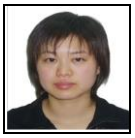
194	**Wu, Xianfeng**		xianfeng.wu@nottingham.ac.uk	Department of Architecture and Built Environment, University of Nottingham, UK	UK

195	**Wu, Li Chuan**		coco@tust.edu.tw	Center for General Education, De Lin Institute of Technology, Taiwan	TWN
196	**Xiao, Dandan**		xiaodandan@ciss.cn	Beijing Sport University, Table Tennis Division	CHN
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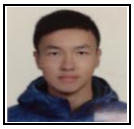
199	**Yang, Derek Han-Chieh**		ks5678guy@gmail.com	Chaoyang University of Technology Department of Leisure Services Management, Taiwan	TWN
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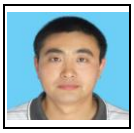
203	**Yuan, Bin**		756843263@qq.com	Sports Department of Chengdu Normal College of Sichuan Sport Pedagogy and Sociology of Sport Department Chengdu Normal College of Sichuan, China	CHN
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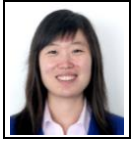
209	**Zhang, Taotao**		zhangtaotao9809@163.com	Department of PE Teaching and Research, Dalian Medical University, China	CHN
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