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# Effects of Neuroticism on Partial and Whole Body Reactions under Stress

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**Abstract:** Effects of neuroticism on partial and whole body reaction times were investigated under stress, or choking conditions in student participants ($N$ = 127). We measured simple and choice reaction times of parts of the body and choice reaction times of the whole body in the participants with high and low neuroticism such as depression, cyclic tendency, inferiority feelings, and nervousness under the controlled stress scenario of being in front of people. Results indicated significant differences in reaction times of partial body, discriminative decisions and choice reaction times of participants in the high neuroticism group. Results of whole body reaction times were opposite to that of partial body reactions. However, a two-way factorial analysis of variance indicated neither a significant main effect, nor interactions between reaction times and personality traits. Whole body reactions suggest that the effects of stimulus transduction process from motor commands to motor outputs via motor neurons has a greater effect in the central nervous system than recognition and decision-making. However, it is possible that changes in the intracortical mechanisms related to cognitions and emotions could be correlated in partial body movements with nearly no muscular activity. Our findings suggested that delays indiscrimination, decision-making, and choice times could affect the performance of individuals.

**Key words:** Personality traits, stress, reaction.

## 1. Introduction

Reactions times are important components of motor movements. The movements of body parts in which there is almost no muscular activity have been evaluated during a target-tracking task, by using MEP (motor evoked potential) involuntary finger movements [1]. The authors concluded that increases in excitability of the corticospinal tract were determined by changes in intracortical mechanisms related to cognitions and emotions. Also, in the case of whole body reactions, the stimulus transduction process from motor commands to motor outputs via motor neurons might have a more significant effect in the central nervous system than recognition and decision-making. Reaction times are physiologically significant, and are simple, noninvasive tests of peripheral, as well as central neural structures [2].

Many processes involved inhuman mental activities, such as information collection, learning, and thinking, among others, are unconscious processes. This characteristic is distinctively observed in athletics and sports. For these reasons, it is possible that unconscious self-awareness, rather than conscious self-awareness, has a larger impact on individual performance in sports [3, 4].

A previous study has suggested that unrecognizable stimuli could increase the speed of simple movements such as key-pressing reactions. Based on this finding, we examined whether participants high in neuroticism,

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compared to those low in neuroticism, would show differences in discrimination times between partial and complete body movements in terms of psychological and behavioral dimensions.

## 2. Purpose

Stress in sports consist of three dimensions [5]: psychological, physiological and behavioral [6-10]. One of psychological stress is pressure, which is also known as choking. In terms of behavioral dimensions, a decline in the speed of movement resulting from choking has been reported [11]. This study was designed to examine whether differences in psychological states decreased the speed of movements, or increased reaction times, by measuring partial body and whole body reaction times under a stress scenario of being in front of people.

## 3. Participants and Method

Undergraduate students ($N$ = 127) participated in an experiment under the controlled stress of being watched by people. We measured simple and choice reaction times in a part of the participant's body, the finger, and the separate reaction times of the left and right sides of the participants' whole body, by using a color detection task. Then, we measured partial and whole body reaction times of the team, by using a crossover design. After the measurement, we divided participants according to their personality trait into two groups, high and low neuroticism, based on their neuroticism score, and conducted a comparative analysis of SRT (simple reaction times), CRT (choice reaction times) and DT (discrimination times) of the two groups of participants.

We used the Japanese version of the Guilford Personality Inventory [12, 13] and conducted between-task comparisons of psychological stress levels resulting from neuroticism. We first extracted four scales of neuroticism: D (depression), C (cyclic tendency), I (inferiority feelings), and N (nervousness). Each scale had a maximum score of 20 points resulting in a total score 80 points. Based on the mean score of the present population (36.4 ± 2 SD points) the participants were divided into two groups. The group of the participants with the scores higher than average was regarded as the unstable group, and the other as the stable group [14, 15].

### *3.1 Ethical Considerations*

This study was approved by the St. Marianna University School of Medicine Clinical Research Committee (No.1976). The Helsinki Declaration was honored. The surveys were completed anonymously, so that the participants' identities were secured. The survey responses have been maintained under careful conditions. No results containing personal information have been released, and the data will not be used for other purposes.

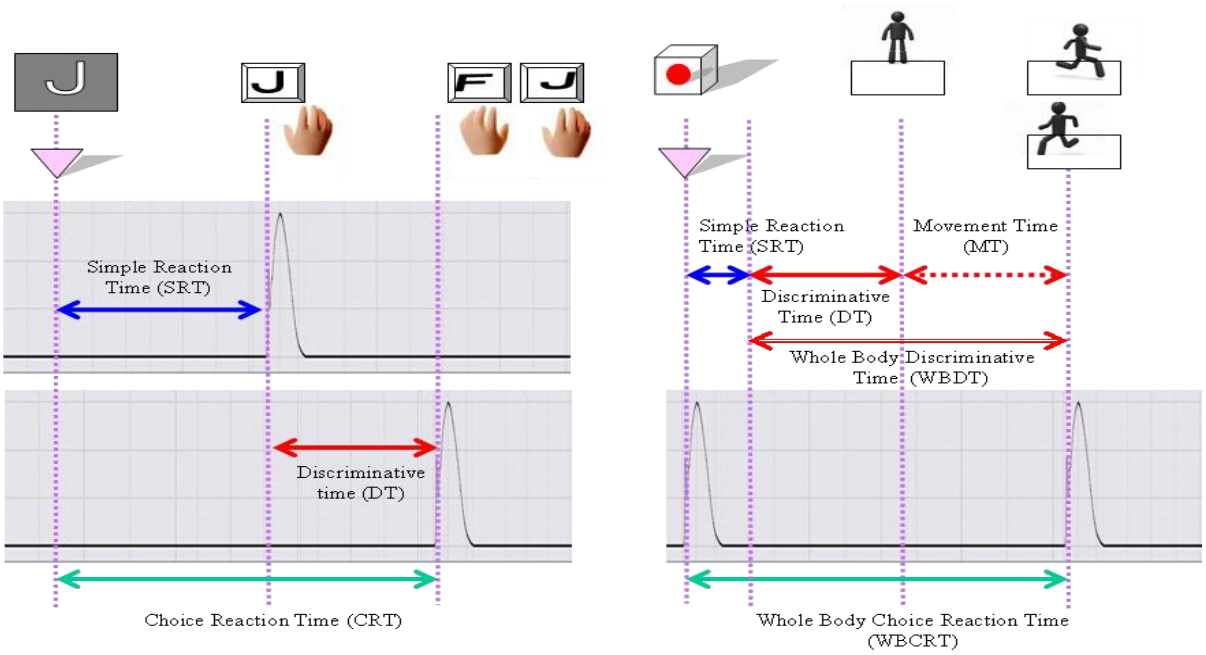
### *3.2 Statistical Analysis*

Of the 127 participants, the results of 120 (72 men and 48 women) were analyzed using a Student's *t*-test for between-groups comparisons and a Paired *t*-test for between-subjects comparison. We also conducted two-way (neuroticism groups × times) repeated measures ANOVA (analyses of variance) by means of Tukey HSD (honestly significant difference). Follow-up univariate analyses of variance (ANOVAs) were used in cases of significant main effects and interaction. Analyses were carried out using SPSS Statistics (ver. 21.0) and a *P*-value was set $P < 0.05$ to determine statistical significance. The criteria for including reaction times in the analysis were reactions exceeding the average reaction time ± 3SD, but not exceeding 200 msec, which were considered to be respectively indicative of reaction errors and reaction failures and were regarded as missing values.

About the experimental condition in this study, to measure partial body reaction times, we used a reaction time assessment software developed for basic experiments by Okamoto Y. (Response/Reaction Time, Keiso Shobo, Tokyo, Japan) [16, 17] and

conducted a randomized signal-timing program with approximately one minute duration of simple reaction time measurement (separately for left and right for fingers) and approximately two minutes duration of choice reaction time testing (simultaneous for left and right fingers). We calculated the median reaction times for each condition. To assess SRT, participants pressed the "J" key of a computer keyboard as quickly as possible when the letter "J" appeared in white text on a black computer screen. The time from the onset of the presentation to participant's key press was regarded as their SRT. To assess CRT, participants selected either the "F (left)" key, or the "J (right)" key near the center of the keyboard, and quickly pressed the selected key. The time from the onset of the presentation to participants' decision-making was considered as their CRT.

To measure participants' whole body reaction times, we used a Multi Jump Tester (DKH, Tokyo, Japan). We presented different colored lights to examine differences in participants' sensory DT (discrimination time). Measurement time was approximately one minute per leg. In this method, participants moved their right or left leg from the front of the mat to its top, as quickly as possible in response to a color light that had been selected by the participants from among three colors, which was presented in a randomized order. The trials were randomized three times each for the left and right legs. Therefore, six measurements were conducted. First, participants stood on the mat to which sensors were attached, and one of the three colored lights was randomly turned on in a random order. They simultaneously lifted their leg from the front of the mat and stepped on the mat when the instructed light came on. We regarded the time from the light turning on to participant jumping as the WBCRT (whole body choice reaction time) of that participant; the time from lifting the leg from the mat to landing on the mat was considered their MT (movement time); and the time required for making the decision to jump (decision making time). The MTs could not measure independently, so the WBDTs (whole body discriminative times) were shown in Fig. 1.




(a) Partial body reaction (b) Whole body reaction

**Fig. 1 Experimental condition.**

DT: The time required for distinction and decision, as reaction start time.

MT: The time required for movement, as muscular contraction time.

WBDTs: The MTs could not measure independently, so the whole body discriminative times (DT + MT = WBDTs).

## 4. Results

Response times of all participants in the present study indicated that the mean partial body SRT was 268.0 ± 33.1 msec. Similar to most Japanese people, approximately about 90% of the participants were right handed [18, 19], probably as the results of early training of children's chopsticks-handling in their homes. Although the CRT and DT of the left finger were slightly delayed (CRT: left; 398.1 ± 51.7, right; 390.9 ± 54.3 msec, DT: left; 130.1 ± 46.6, right; 122.9 ± 47.7 msec), there were no statistically significant differences either between the left and the right hands or between men and women (Table 1).

Results also indicated that whole body CRTs were evenly distributed for both the left and right sides of the body and there were no significant differences either in the side of the bodies or in gender.

### *4.1 Partial Body Scores of High and Low Neuroticism Groups*

Next partial body tasks were compared between the high neuroticism group and the low neuroticism group. Left CRTs were 389.2 ± 52.9 msec for the low neuroticism group and 407.2 ± 49.7 msec for the high neuroticism group. Right CRTs were 383.1 ± 50.0 msec for the low neuroticism group and 398.8 ± 58.1 msec for the high neuroticism group. Although the high neuroticism group had slightly longer CRTs than the low neuroticism group, there were no significant differences in CRTs between the two groups for left or right fingers as follows, left: $t(116) = -1.908$, $P = 0.059$, right: $t(116) = -1.575$, $P = 0.118$.

However, as can be seen in Fig. 2, there were significant between-group differences ($P < 0.05$) in partial body DTs. Left finger DTs were 120.4 ± 44.5 msec for the low neuroticism group and 140.1 ± 47.5 msec for the high neuroticism group, $t(116) = -2.334$, $P = 0.021$. Right hand DTs were 114.3 ± 42.2 msec for the low neuroticism group and 131.7 ± 52.0 msec for the high neuroticism group, $t(116) = -2.000$, $P = 0.048$. We found that high neuroticism group had slightly longer DTs than the low neuroticism group, possible indicative of reduced central processing in the brain.

### *4.2 Whole Body Scores of High and Low Neuroticism Groups*

Whole body CRTs of the high and low neuroticism groups showed different trends to that of partial body results (as shown in Fig. 3). There were differences between the left and the right (left: the low neuroticism group 420.7 ± 119.0 msec, the high neuroticism group 366.4 ± 105.1 msec, right: the low neuroticism group 408.1 ± 109.7 msec, the high neuroticism group 370.7 ± 97.5 msec). We found that the WBCRTs of the low neuroticism group were shorter than those of the high neuroticism group; left:

**Table 1 Partial and Whole body reaction times (average ± standard deviation).**

| Partial Body Reaction | | | | | |
|---|---|---|---|---|---|
| (msec) | SRT (AV) | CRT (Left) | DT (Left) | CRT (Right) | DT (Right) |
| Average | 268.0 | 398.1 | 130.1 | 390.9 | 122.9 |
| ±SD | 33.3 | 51.7 | 46.6 | 54.3 | 47.7 |
| Whole Body Reaction | | | | | |
| Left sides (msec) | 1st time | 2nd time | 3rd time | WBCRT | WBDT |
| Average | 392.0 | 406.7 | 393.6 | 393.3 | 156.1 |
| ±SD | 133.6 | 133.8 | 120.8 | 114.5 | 93.1 |
| Right sides (msec) | 1st time | 2nd time | 3rd time | WBCRT | WBDT |
| Average | 400.5 | 394.8 | 399.3 | 390.8 | 141.9 |
| ±SD | 112.5 | 122.5 | 126.9 | 104.5 | 91.2 |

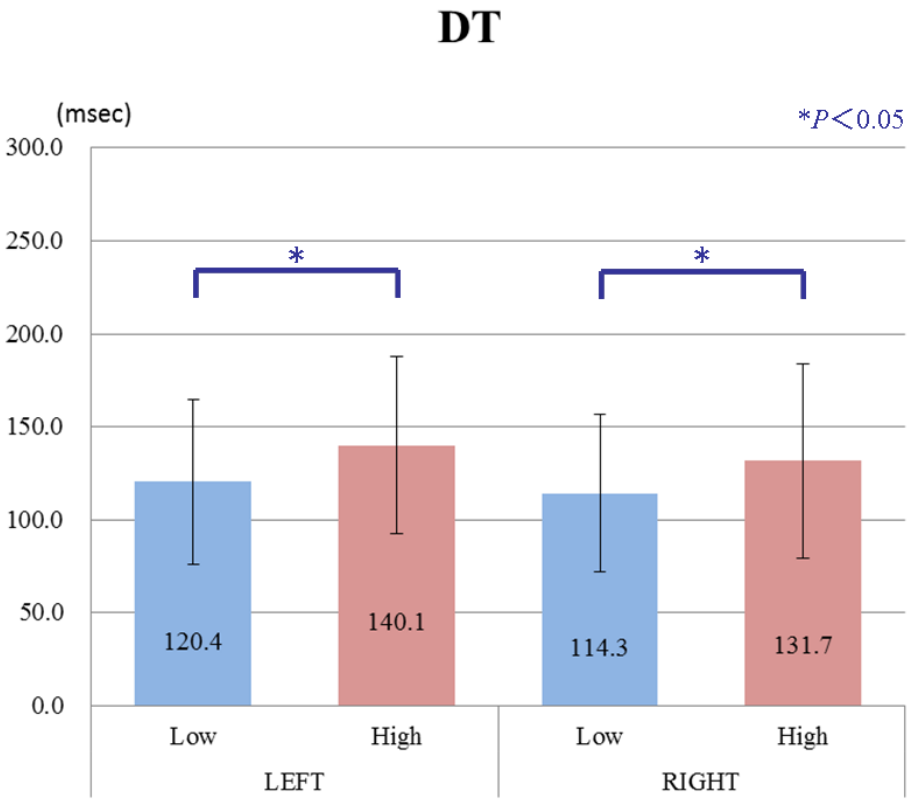



**Fig. 2 Partial body discriminative time (by neuroticism traits).**

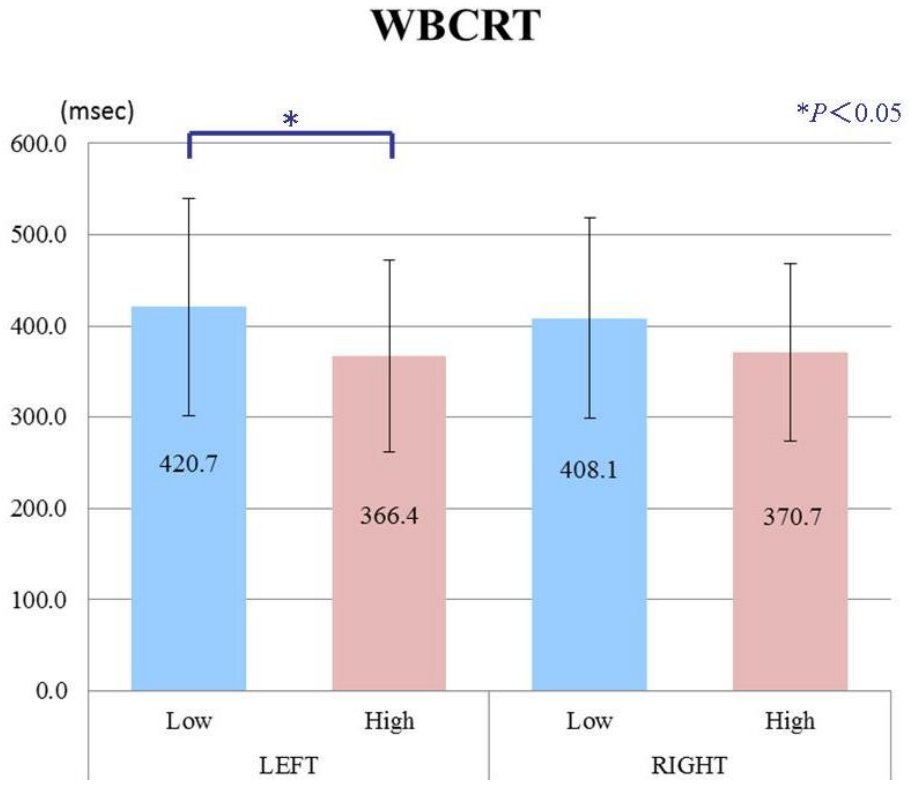



**Fig. 3 Whole body choice reaction time (by neuroticism traits).**

$t(113) = 2.594$, $P = 0.011$, right: $t(113) = 1.925$, $P = 0.057$. This finding suggests opposite effects of neuroticism traits on partial body and whole body reactions.

We conducted two-way factorial ANOVA of whole body reaction measurements, with measurement period and personality traits to examine differences in repeated measurement periods. Results indicated neither a significant main effects nor interactions; left: $F(2, 168) = 0.082$, right: $F(2, 168) = 0.595$, $P$s > 0.05 (Fig. 4).

It is suggested that slight differences between the left and the right sides of the body were probably related to whether or not it was the dominant leg of the participants. The high neuroticism group had a shorter response time and their performance improved as they repeated the task. The low neuroticism group was more likely to decrease the speed of their performances as the task was repeated. The results were in line with the degrees of performance observed in relation to introversion versus extroversion personality traits [20, 21]. The high neuroticism group was more likely to improve their performances as they repeated a task and the low neuroticism group was more likely to perform at their best the first time.

If we review whole body reactions by breaking them down according to the four personality scales of neuroticism (among the four scales), "D (Depression)" and "N (Nervousness)" scales of the two neuroticism group indicated significant differences by repeated measures ANOVA. (N) scale of the high neuroticism group, indicated a two factor interaction (emotional groups × period) on the right leg of the body, which was the dominant side of most participants, $F(4, 280) = 3.442$, $P = 0.035$. Especially in (D) scales on both sides and (N) scale on the right leg of the body, these results indicated that the high neuroticism group tended to be shorter at first time, but were longer at the 2nd and the 3rd time on the estimated averages.

Differences between the left and the right sides were also observed in whole body DTs (left: low neuroticism group 175.5 ± 99.6 msec, high neuroticism group 135.9 ± 82.6 msec, right: low neuroticism group 153.2 ± 97.3 msec, high neuroticism group 127.9 ± 83.3 msec) as see Fig. 5. A Difference ($P < 0.05$) was also observed in the left leg between the two groups, $t(94) = 2.107$, $P = 0.038$. We also observed a difference in the same direction for the right leg, which did not reach significance, $t(102) = 1.408$, $P = 0.162$. The whole body DTs tended to be opposite of DTs in partial body reactions; the WBDTs of high neuroticism group were shorter than those of low neuroticism group on average.

## 5. Discussion

Results indicated no significant differences between

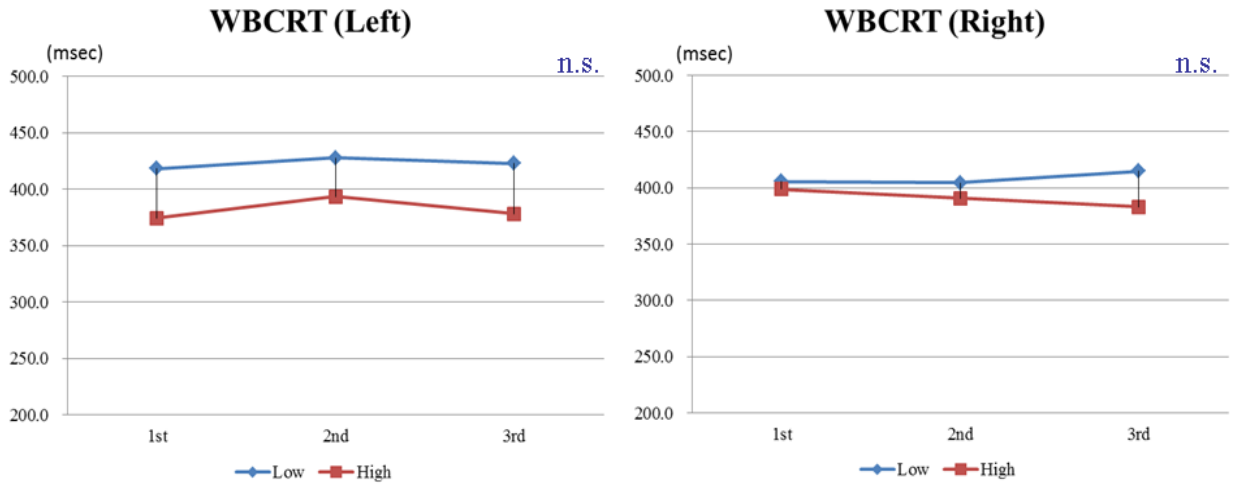



**Fig. 4 Whole body choice reaction times (by neuroticism traits).**

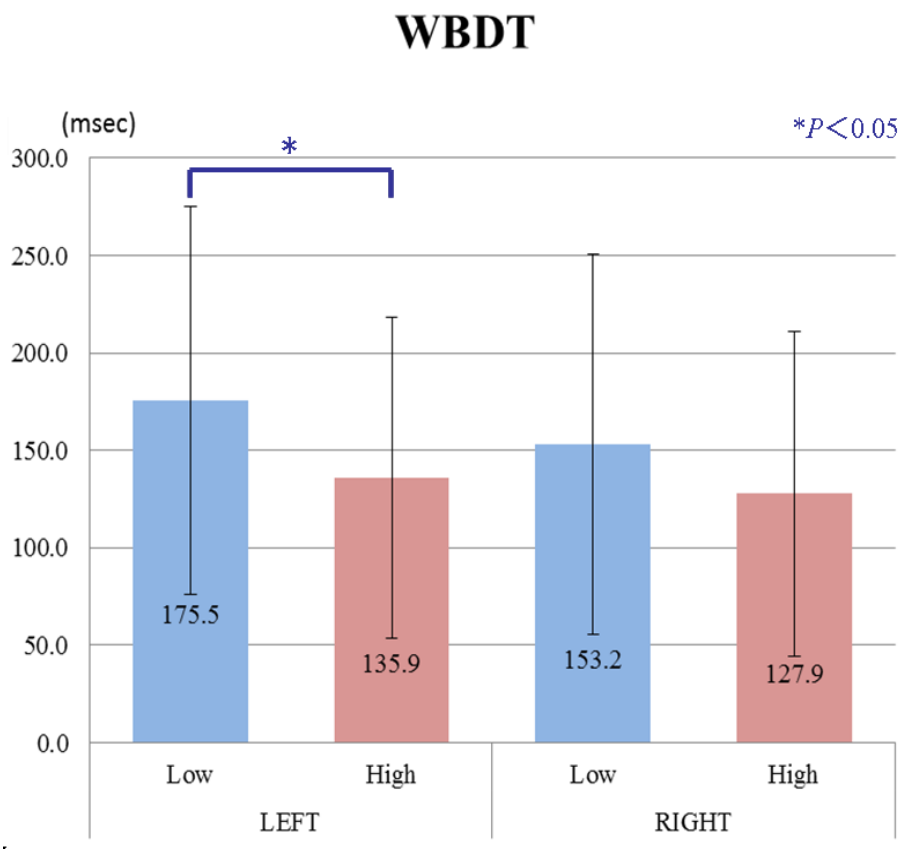



**Fig. 5 Whole body discriminative time (by neuroticism traits).**

the two neuroticism groups in simple reactions, although the SRTs of the high neuroticism group were slightly shorter than that of the low neuroticism group. There were significant differences between the two neuroticism groups in partial body DTs for both left and right fingers. Although this indicated a weak causative relationship with choking in front of people, we suggest a possible delay in the central processing system of individuals when they are in a nearly unconscious state.

Moreover, the high neuroticism group had a larger standard deviation and a higher degree of dispersion in the semi-interquartile range, which was likely skewed in the direction of longer reaction times (Fig. 6). This might have induced an "uncertainty of movement". Partial body movements, which have nearly no muscular activity, perceptual conflicts such as tiredness, anxiety, and health problems, as well as environmental stressors, such as the need for making social adjustments might influence individuals' performances by decreasing efficiency [22]. Our results corroborated this view. Also, the results supported the findings by Tanaka et al. [1, 23], suggesting that excitability in the corticospinal tract was correlated with changes in the intracortical mechanisms related to cognition and emotions.

In contrast, in the case of whole body reactions, the effects of the stimulus transduction process from motor commands to motor outputs via the pyramidal tract, extrapyramidal tract, and motor neurons was larger than recognition and decision-making in the central nervous system. These results suggest that neuroticism traits do not always have a significant effect on performance [24].

However, if we postulate that there are no differences in the time of stimulus transduction to the whole body, the significant "delays in DTs" observed in the high neuroticism group in the present study

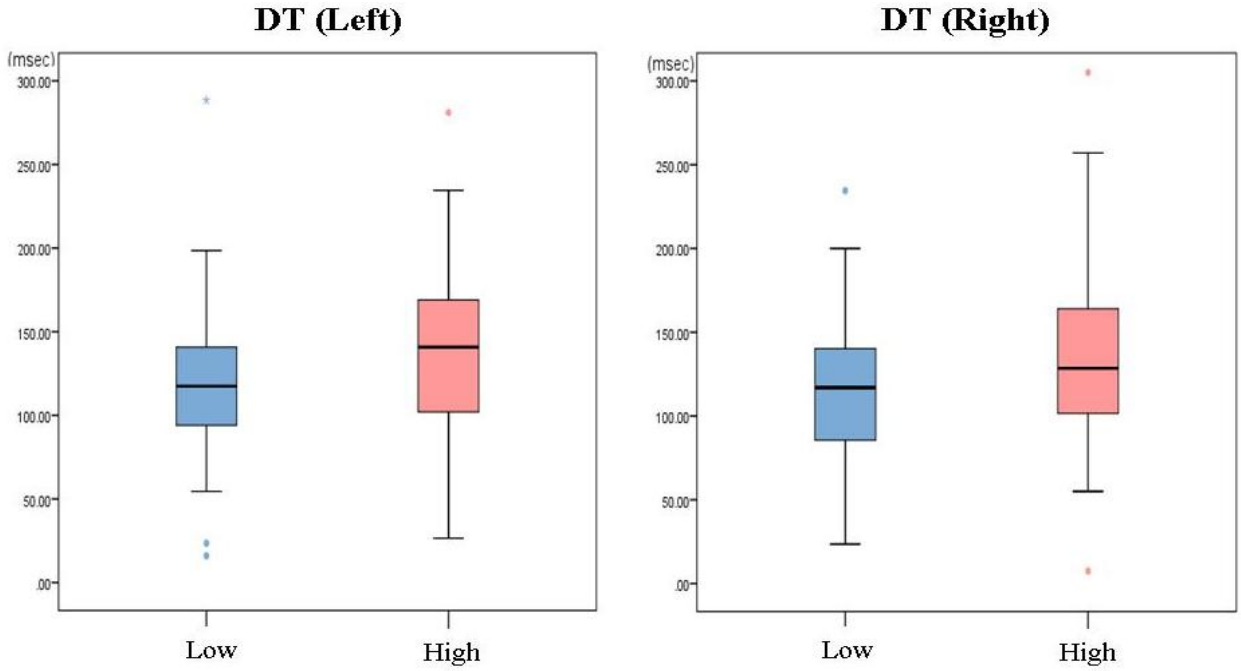



**Fig. 6 Dispersion of discriminative time (by neuroticism traits).**

might decrease individual performance. In particular, children from 6 to 12 years of age are in a growth period with ongoing development of their nervous system. In the case of such children, the effects of a delayed stimulus transduction time in the motor command output system related to emotions, could have significant effects on their performance.

## 6. Future Issues

It has been suggested with regard to whole body reactions that "emotionally stable groups have a faster whole body reaction time" under psychological stress in the context of personality traits, and that "there is a correlation between pressure and performance" [21, 25-28]. However, our results did not support these findings, because individuals in the present study were facing weak pressure, which might be correlated with attention and concentration for particular types of performance. This could be because an optimal level of tension might have a facilitating effect on choking. This experiment examined differences in participants' whole body reactions under slight pressure, which unlike under strong pressure, might have been insufficient to generate differences in reaction times.

In sports, it has been regarded that reaction time and performance before and after official games differ according to reaction times and neuroticism. However, in the present experiment on whole body reactions, we found the effects of motor control time, or the effects of the stimulus transduction process from the motor command to the motor output via the pyramidal tract, extrapyramidal tract, and motor neurons may have a larger effect. Our findings suggest that in the case of partial body movements, in which there is almost no muscular activity, changes in the intracortical mechanisms related to unconscious cognitions and emotions might be correlated.

## Acknowledgements

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# Beach Handball and Beach Volleyball as Means Leading to Increasing Physical Activity of Recreational Sportspeople—Pilot Study

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**Abstract:** The sample consisted of sixteen man of aged average 24.5 year, average height 181.9 cm and weight 80.4 kg. The average of static pulse rate was 56.4 beats $min^{-1}$. The average heart rate max was 189.7 ± 7.8 beats $min^{-1}$. For the calculation of $HR_{max}$ (maximal heart rate), a mathematical figure $HR_{max}$ = 207 – (0.7 × age) was used. Probands have participated on the same day on a tournament in beach and handball tournament. HR (heart rate) was monitored via Sport Tester Polar. The results were evaluated by Polar software. The data was statistically compiled with the use of arithmetic average and standard deviation. The players played three matches in beach volleyball on one set to 21 points (necessary difference of 2 points). One set lasted approximate 13.5 min. After a break, they went to play three matches in beach handball. The average HR during beach volleyball was 149.5 ± 14.1 beats $min^{-1}$ and 164.3 ± 14.5 beats $min^{-1}$ in beach handball. In beach volleyball, we also focused on players' intensity load differences 172 ± 14.1 beats $min^{-1}$and goalkeepers 156.5 ± 16.6 beats $min^{-1}$. In the beach volleyball, players spend most of their playing time on the playing area in the zone intensity load 80%-90% $HR_{max}$ (36% playing time). In the beach handball, players spend most of their playing time on the playing area in the zone intensity load 90%-100% $HR_{max}$ (39% playing time).

**Key words:** Sport games, heart rate, physical activity, health.

## 1. Introduction

Man as a human being is both morphologically and functionally adapted to the way of life of being able to deal with a difficult physical activity which has always been a part of basic attribution of living and surviving. Health problems and diseases such as obesity, diabetes mellitus II type, hypertension, metabolic cardiovascular syndrome, ischaemic heart disease, peripheral vascular disease, lower back pain, osteoporosis and fractures are mostly connected with the inactive way of living and sedentary jobs, and they are said to be the cause of the mentioned chronic health diseases. The intensified physical activity has a beneficiary potential on better health state by evocating adaptive changes in most of the organs and systems, their function and regulation in the human body.

One of the most important things for physical education is the human biological need for a physical activity. Satisfying such a need comes with selection. From the natural need for an activity is, as a consequence, a new social need (a motive for social contact) has developed. The actual needs related to physical activity are based on stimulatory tendencies of motivational cluster such as need for change, need for activity repetition, health care need, etc. The necessary condition for doing a sport is the joyful experience. Presently, the joyful experience coming through a physical activity is one of the most important motives of it. We also speak here about an attractiveness of sport in the means of offering a wide range of unconventional, funny and socializing physical

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activities such as co-educated forms of PA (physical activity), meeting with friends, etc. Beach games have become a big temptation not only for professional athletes, but also for common recreational sportspeople.

The basic point of beach games was the active way of doing leisure time activities by the sea or on the beach. The main idea was to relax, have fun, meet friends, gain experience, and have better health condition.

Beach volleyball combines all positive aspects of team sports-ability to play theball, speed and accuracy of movement, flexibility, deemed necessary to link individual actions and thinking of the teammates, etc. To these positive aspects, we can add multilateral influence of the natural factors in outdoor sports [1]. The popularity of beach volleyball is increasing, but it is a sport in the early stages of its development and it is necessary to introduce quality materials to support the development of players and coaches through practical advice [2].

Beach handball is played in a 15 × 12 m sandfield. Each equipment has one goalkeeper and three players of field that compete during two halves of 10 minutes each (2 × 10 min). They follow the applicable rules of in door handball, with the exception of the zone of change, which is an entire band for each team, and the score of the goalkeepers, which counts double [3].

There are few authors dealing with topics such as basketball, football, volleyball, beach football, indoor football, rugby and who also deals with heart rate monitoring during competition games [4-14]. All of them by Cobos include a recording of heart rates by telemetry, a valid system of measurement [15-17]. It gives us information about heart response when performing exercises that express a huge variability of intensity [18] and, at the same time, it gives us an energetice information about the performed exercise [19].

There are only few surveys done on this topic in beach volleyball [20, 21], beach football [7] and beachhandball [22]. As a consequence to these facts, we have done a research based on load intensity of recreational players in beach volleyball and beach handball.

Research of this study was a part of students' granted competition project nr. 43510007: "Analysis of players' intensity during competitions in sport games (basketball, football, handball and volleyball)" at Palacky University in Olomouc.

The main goal of this research was to compare the intensity load of recreational players in beach volleyball and beach handball in competitions on the basis of analysing heart rate monitoring and to analyse the intensity load of recreational players in beach volleyball and handball competition.

## 2. Methods

### *2.1 Participants*

Participants were randomly chosen from students studying physical education and sport in Faculty of Physical Culture on Palacky Univerzity Olomouc, Czech Republic. The research battery consisted of 16 men in the age average of 24.5 ± 3.74 years, of average height 181.9 ± 6.02 cm and weight 80.4 ± 7.5 kg. The players' average $HR_{rest}$ was 56.4 ± 6.89 beats $min^{-1}$. The average $HR_{max}$ was 189.7 ± 7.8 beats $min^{-1}$.

Due to lack of financial and organizational support, it was impossible to make exercise tests for getting the $HR_{max}$. As a matter of fact the $HR_{max}$ was figured out from this formula: $HR_{max} = 207 – (0.7 \times age)$. The heart rate monitoring was realized by the help of Team Polar monitors. The results were evaluated by Polar software.

### *2.2 Data Gathering Description*

Posters informing about the participation on the tournament were posted in advanced. The poster informed about registration to this tournament for men's pairs in beach volleyball and a drawing lot tournament in beach handball. There was an informative meeting for all of the teams about the

tournament system, rules for both sports and about heart rate monitoring. The monitoring was held in TJ Milo beach courts in Olomouc. The tournament in volleyball was held on four beach courts, and the handball tournament was held on just one court.

The beach volleyball tournament lasted from 9 to 11 o'clock and the drawing lot tournament of three teams (two five-member teams and one six-member team) lasted from 12 to 14 o'clock. Before beach volleyball beginning, all of the probands received the heart rate monitors which they put on their chests. The teams received points from both tournaments to the final list. The weather was sunny and windless; the temperature was about 20 ℃.

Each team/pair played three matches for one set to 21 points (two-point difference necessary). Then each proband played two matches in beach handball.

*2.3 Statistical Analysis*

The data was with Software Statistica (9.0 version, StatSoft, Inc., Tulsa, USA) processed by the arithmetical average, percentage formulas, standard deviation and statistical importance—Man-Whitney test. There was a statistical significance $P < 0.05$. The statistical calculations were based on the time data received from sport testers (how many seconds the players spent in each load intensity zone). All the probands participated on beach volleyball and handball tournament held in the same day.

## 3. Results

The players played in the beach volleyball tournament three matches each for one set only (end by receiving 21 points, but two-point difference necessary). Each set lasted approx. 13.5 ± 5.3 minutes. The players' average HR was 149.5 ± 14.1 beats $min^{-1}$.There is no significant difference between each load intensity zones (Fig. 1) on the significance level $P < 0.05$. The probands mostly, more than 50%, respectively, appeared in the intensity below an anaerobic threshold (< 85% $HR_{max}$). The motion on the court was also influenced by the level of players' skills.

After beach volleyball tournament (sixty-minute break), the probands played tournament (three matches) in beach handball. The average heart rate players was 164.3 ± 14.5 beats $min^{-1}$ in matches beach handball. The significant difference was while comparing load intensity of in the load intensity zone 90%-100% $HR_{max}$ and 70%-80% $HR_{max}$ ($P = 0.0201$) resp. < 70% $HR_{max}$ ($P = 0.0455$). The matches were interrupted only minimally (imprecise ball passing, shooting out of the goal, fouls etc.) and the level of the matches was appropriate to recreational players. The load intensity was more than 50% above the anaerobic threshold

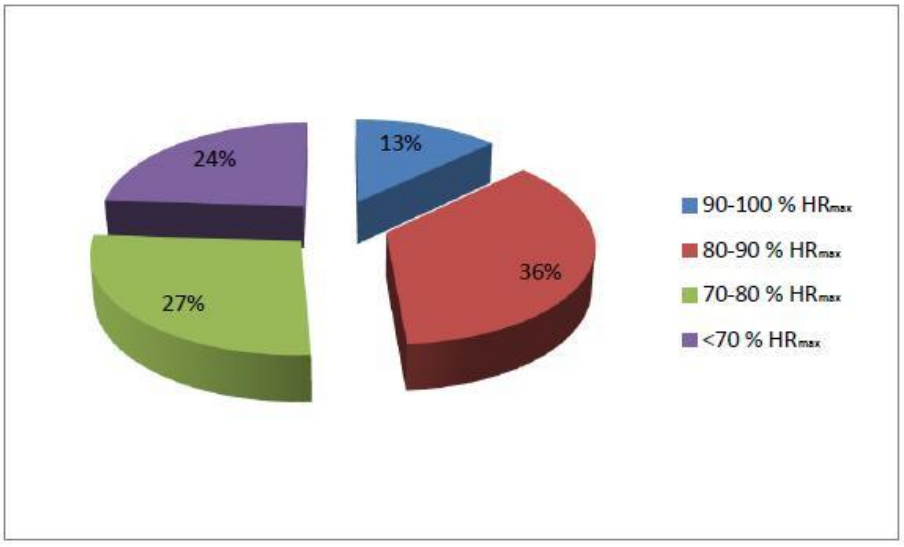


**Fig. 1 Load intensity of recreational players in beach volleyball matches.**

(> 85% $HR_{max}$). Even the load intensity of goalkeepers was compared here. Due to the tactic and rules specification, there was no statistically significant difference between field players and goalkeepers. It was due to the same game participation of goalkeepers. When losing a ball, the goalkeeper had to leave the court immediately, so the next goalkeeper could run into the goal area. Each team had two goalkeepers.

The only one significant difference was while comparing load intensity of beach handball and beach volleyball matches only in the load intensity zone 90-100% $HR_{max}$ ($P$ = 0.0365). We consider higher load intensity to be in the beach handball recreational players. Playing beach handball should lead to improving one's physical ability and fitness factor. Playing beach volleyball should result in weight reduction. This fact is not in comparison with beach football significantly important, but from the practical point of view, it tells us about higher load intensity in beach handball matches (Fig. 3).

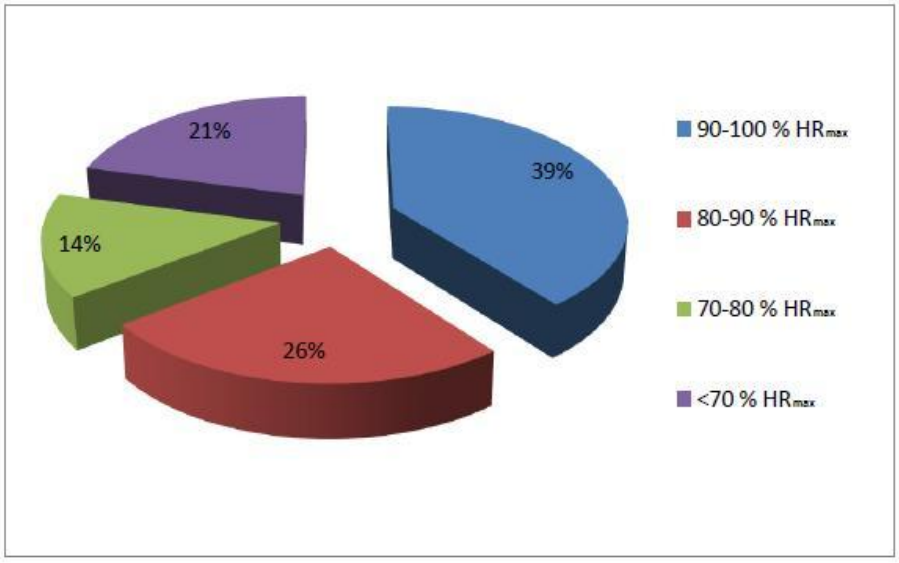


**Fig. 2 Load intensity of recreational players in beach handball matches.**

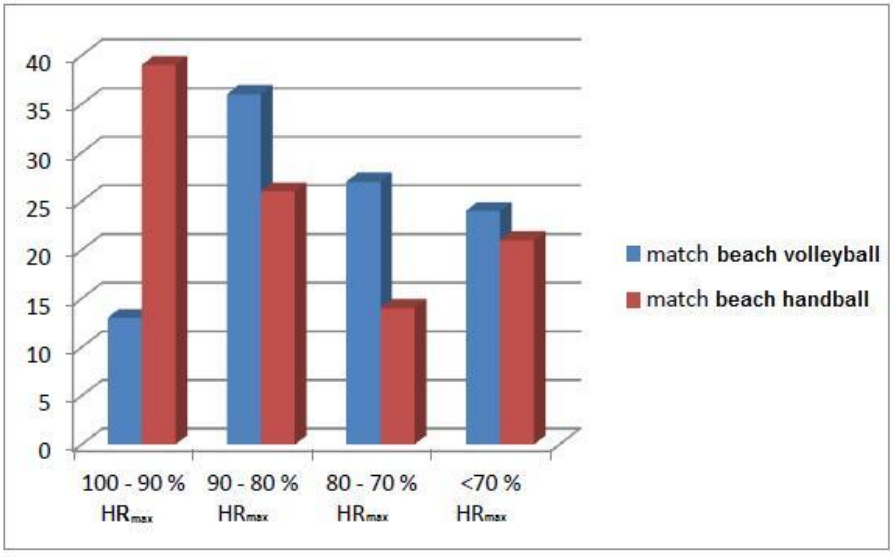


**Fig. 3 Comparison of recreational players' intensity in beach handball matches and beach volleyball matches.**

## 4. Summary

The players spent 24 ± 20.9% playing time in load low intensity zone (<70 % $HR_{max}$) in match beach volleyball. Players beach volleyball spent most playing time (36%) in load intensity 80%-90% $HR_{max.}$ In the match beach handball, players spent most playing time (39%) in load intensity 90%-100% $HR_{max}$ and little playing time in load intensity 70%-80% $HR_{max}$.

In beach handball, we monitored the average HR of the players that was 172 ± 14.1 beats $min^{-1}$ and of the goalkeepers it was 156.5 ± 16.6 beats $min^{-1}$. The players' average HR in volleyball match was 149.5 ± 14.1 beats $min^{-1}$.Statistically important difference between each zone was only in the beach handball matches. In comparison with both sports, the statistically important difference was not confirmed. As a matter of fact, only the practical importance can be evaluated. Beach handball recreational players spent in the zone above anaerobic threshold more than 50% of the whole time in comparison with beach volleyball players, who spent there only 39%.

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# Effect of an Acute Exercise Session on Body Composition Using Multi-Frequency Bioelectrical Impedance Analysis in Adults

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**Abstract:** The purpose of this investigation was to examine the effect of an acute bout of aerobic exercise (AE) and resistance exercise (RE) on body composition measured by multi-frequency bioelectrical impedance analysis (MBIA) in adults. Ninety-five recreationally active young adults (46 women and 49 men) reported for testing on three occasions. After an initial MBIA assessment, subjects performed 45 minutes of continuous AE, RE, or did nothing, which served as the control (CON). During the AE trial, subjects performed an acute bout of treadmill exercise at 60%-75% of their age predicted maximal heart rate ($APHR_{max}$). The RE trial consisted of an 8-exercise circuit consisting of; 3 sets of 10-12 repetitions at 65%-75% of their one-repetition max (1RM) for each exercise. During the CON trial, subjects sat quietly in the laboratory. Body composition was reassessed immediately following the exercise bouts for comparison. Mean percent body fat (%BF) decreased following the exercise bouts (AE = 0.7%, RE = 1.6%; $P < 0.001$) likely due to significant ($P < 0.001$) reductions in impedance (AE: 40Ω, 32Ω, and 29Ω; RE: 45Ω, 29Ω, and 28Ω) measured at 5, 50 and 500 kHz. Conversely, significant increases in %BF (0.7%, $P < 0.05$), body mass (0.2 kg, $P < 0.001$), and impedance at 5 and 50 kHz (15Ω and 16Ω; $P < 0.001$) were observed following the CON trial. These findings support that MBIA assessments should be performed prior to exercise in order to prevent exercise-induced reductions in %BF values.

**Key words:** BIA, bioimpedance, percent body fat, body mass.

## 1. Introduction

Obesity is a major public health problem in the United States, which causes a wide range of serious complications and increases the risk of illness and premature death. According to the Center for Disease Control and Prevention, health problems associated with obesity include: increased risk of type 2 diabetes [1], sleep apnea, asthma [2], joint problems and musculoskeletal discomfort [3], gallstones [4], stroke [5], and cancer [6]. In addition, obesity is also associated with high blood pressure and high cholesterol, both of which contribute to cardiovascular disease which is the leading cause of death in the United States [7]. Body mass index data indicates that obesity has been significantly increasing among the US population over the past 30 years [8], with recent estimates showing that nearly one-third of adults being classified as obese (32.2% of men and 35.5% of women) [9].

As awareness of the obesity epidemic has increased, so too has the interest in effective weight management programs designed to improve eating behaviors and increase physical activity. To encourage participation, employers often offer incentives to employees who lose weight [10]. In order to track the effectiveness of these intervention programs, accurate methods of measuring body composition are necessary [11].

One popular method of assessing body composition is bioelectrical impedance analysis (BIA). During the assessment a small, undetectable electrical current is passed through the body, and the resistance to the

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current flow (impedance) is measured by the analyzer [12, 13]. Lean body mass is highly conductive to the current flow because of a high water and electrolyte content (low impedance), while fat mass is a poor conductor [11]. From the impedance measurement, BIA devices estimate body composition [body mass (BM), lean body mass (LBM), and total body water (TBW)] [14]. Multiple BIA analyzers are currently available including leg-to-leg (LBIA), segmental (SBIA), and multi-frequency (MBIA) device.

Acute shifts in fluid and electrolyte balance which occur throughout the day have been shown to alter BIA body composition estimates by altering the impedance measurement [15]. As such, several pretesting guidelines have been designed to control for these fluctuations in hydration [14]. For instance, avoiding exercise 12 hours prior to testing is a common BIA guideline. Previously, Dixon et al. in two separate studies, examined the effect of aerobic exercise [13] and resistance exercise [16] on body fat using LBIA and SBIA devices. Following 40 minutes of aerobic exercise at 60%-75% of the individual's age predicted heart rate maximum ($APHR_{max}$), they found a 1.5% mean decrease in LBIA assessed percent body fat (%BF), and a 1.2% mean decrease in SBIA in 63 recreationally active adults (31 women; 32 men) [13]. In another study [16], %BF reductions (LBIA = 0.4%; SBIA = 1.2%) were also observed following an eight exercise resistance training circuit in 86 young adults (45 women; 41 men). Recently, Andreacci et al. examined the impact that cycle ergometry exercise had on %BF estimates using LBIA and SBIA [12]. Seventy-four college-aged adults performed two 30-minute exercise sessions, as well as a day which served as the control. The subjects' body composition was measured pre and post exercise, it was found that cycle ergometry altered mean %BF estimates of LBIA 0.5%, and SBIA 1.0% [12].

Although previous studies have explored the impact of acute exercise on LBIA and SBIA body composition measurements, to our knowledge, no studies have examined MBIA technology. MBIA differs from the majority of LBIA and SBIA devices by incorporating three electrical frequencies (5, 50, and 500 kHz) into the measurement rather than a single standard frequency of 50 kHz [17]. The multiple frequencies enable the determination of both extracellular and intracellular water [18]. Extracellular water can be determined using low frequencies (≤ 50 kHz), while higher frequencies (≥ 200 kHz) are necessary to penetrate cell membranes and determine intracellular water [18]. This MBIA determination of intracellular fluid is an assessment that previous single-frequency BIA technology could not provide.

Previous research has shown changes in LBIA and SBIA body composition measures following acute bouts of exercise [12, 13, 16]. The impact that exercise has on the more advanced MBIA technology is currently unknown. Given that MBIA expands upon this originally technology by determining both intracellular and extracellular water, one may anticipate greater exercise-induced alterations in body composition measures. As such, the purpose of this study was to examine the effect of an acute bout of aerobic exercise (AE) and resistance exercise (RE) on body composition measured by MBIA (InBody 520) in adults.

## 2. Methods

### *2.1 Experimental Approach to the Problem*

Each subject reported to the exercise physiology laboratory on three separate occasions within a seven-day period. In order to control for experimental bias, the testing order was counterbalanced prior to the first day.

On the initial visit, anthropometric data was recorded for each subject. During each visit, subjects underwent an initial MBIA assessment (PRE). Subjects then performed 45 minutes of a RE, AE, or the control (CON) trial. During the RE trial, each subject completed an eight-exercise circuit protocol consisting of three sets of 10-12 repetitions for each exercise.

During the AE trial, all subjects were asked to complete 45 minutes of treadmill exercise at 60%-75% of their $APHR_{max}$. During the CON trial, subjects were asked to sit quietly for the duration of 45 minutes. Subjects were provided with a bottle of water (500 mL) for consumption during all three trials. A second MBIA assessment was then performed immediately following each trial (POST).

*2.2 Subjects*

Ninety-five (49 men, 46 women) recreationally active college aged adults were recruited for the study, subject characteristics can be observed in Table 1. Subjects were recruited via flyers posted throughout the campus. The Bloomsburg University Institutional Review Board approved the study protocol and methods. Each subject completed a Physical Activity Readiness Questionnaire (PAR-Q), as well as an informed consent form prior to participation.

*2.3 Procedures*

Prior to testing, subjects were asked to adhere to strict pretesting guidelines: (1) no food or drink two hours prior to testing; (2) no exercise 12 hours prior to testing; (3) no alcohol consumption 48 hours prior to testing; and (4) no diuretics seven days prior to testing. Compliance to the guidelines was verbally confirmed before each experimental trial. Urine specific gravity (USG), was measured by a hand-held digital fiberoptic refractometer (Misco Corp., Cleveland, OH, USA), prior to the initial MBIA assessment, in order to determine hydration state [19].

The AE exercise bout consisted of 45 minutes of continuous walking/jogging on a treadmill. The exercise intensity was determined as a percentage of each individual's $APHR_{max}$, and kept between 60%-75%. A polar heart monitor was used to ensure that subjects remained within the desired target HR range during the test. Subjects were permitted to adjust speed and grade as needed during the test to remain within the target HR zone.

The RE trial required each subject to complete an eight-exercise circuit protocol consisting of three sets of 8-12 repetitions at 65%-75% of their one repetition max (1RM) for each exercise. The eight exercises included; dumbbell chest press, lat pull-down, lunges, abdominal crunches, seated row, shoulder press, bicep curl, and triceps extension. Three full circuits were performed within the 45 minutes, at their own pace. HR was recorded after each circuit set using a polar heart monitor.

The MBIA measurements were measured using the InBody 520 (Biospace Co., Beverly Hills, CA, USA). The InBody 520 measured the direct segmental impedance across both legs, arms and trunk at multiple frequencies (5, 50, and 500 kHz). The InBody system has an 8-point electrode placement, which contacts the body at two points in each hand and foot. Body mass, and five segmental impedance measurements (right arm, left arm, trunk, right leg, and left leg) are automatically measured while the subject stood erect holding the electrodes with their bare feet placed properly on the contact electrodes on the MBIA platform. As recommended by the manufacturer [18], the subject's arms were held straight-down without touching the sides of their trunk.

*2.4 Statistical Analysis*

Data was analyzed using SPSS 22 for Windows (SPSS, Inc., Chicago, IL). All values are expressed as

**Table 1 Subject Characteristics.**

| | Age | Height | Body mass | BMI |
|---|---|---|---|---|
| | (yrs) | (cm) | (kg) | ($kg/m^2$) |
| Women ($n$ = 46) | 21.2 ±1.9 | 164.4 ±5.2* | 62.9 ±7.8* | 23.2 ±2.4* |
| Men ($n$ = 49) | 22.1 ±3.3 | 177.5 ±6.8 | 81.8 ±13.3 | 25.9 ±3.8 |
| Total ($n$ = 95) | 21.7 ±2.6 | 170.9 ±6.0 | 72.4 ±10.6 | 24.6 ±3.1 |

All values are mean ±*SD*. BMI = body mass index.
*$P$ < 0.05 difference when compared to men.

mean ± SD, if normally distributed. Paired samples *t*-tests were used to detect significant differences (pre vs. post) in the MBIA body composition for each of the experimental trials. Statistical significance was established a priori at $P \leq 0.05$ for all analyses. Bland-Altman plots [20] were used to assess individual differences in %BF, plotted against BM pre- to post exercise. The reliability (intraclass correlation coefficient) of the body composition variables determined by MBIA for each experimental trial exceeded 0.843.

## 3. Results

The MBIA body composition data of the group for the CON, RE, and AE trials are presented in Table 2. Following RE, significant ($P < 0.05$) reductions were observed for fat mass (1.2 kg), %BF (1.6%), and impedance (45Ω, 29 Ω, and 28Ω) at the levels of 5, 50, and 500 kHz respectively (Table 2). Significant ($P < 0.05$) increases were also observed after RE in body mass (0.1 kg), TBW (1.0 kg), intracellular water (0.6 kg), and extracellular water (0.3 kg). No significant differences were observed post exercise in FFM in the RE trial (Table 2). USG measured prior to exercise averaged 1.02 g/ml. The average HR for all subjects during the resistance trial was 139 ± 19 beats per minute.

Following AE, significant ($P < 0.05$) reductions in body mass (0.1 kg), FM (0.4 kg), %BF (0.7%), and impedance (40Ω, 32Ω, and 29Ω) at the levels of 5, 50, and 500 kHz respectively, were observed. Significant ($P < 0.05$) increases were observed in FFM (0.4 kg), TBW (0.3 kg), intracellular water (0.1 kg), and extracellular water (0.1 kg; Table 2). Measured USG averaged 1.02 g/ml. The average HR for all subjects during the aerobic trial was 144 ± 19 beats per minute.

During the control (CON) trial significant ($P < 0.05$) increases were observed in body mass (0.2 kg), fat mass (0.5 kg), %BF (0.6%), and impedance at 5 kHz (15Ω) and 50 kHz (16Ω). Significant ($P < 0.05$) decreases were observed in FFM (0.3kg), TBW (0.2 kg), and extracellular water (0.1 kg). No changes were observed in intracellular water, or impedance at the level of 500 kHz (Table 2). The average measure of USG was 1.02 g/ml.

Bland-Altman plots were used to show the difference in %BF (pre – post) vs. body mass, for each condition (Fig. 1A, 1B, 1C). There was no relation between the magnitude of %BF change (pre-post) and BM in any of the trials.

## 4. Discussion

Due to the prevalence of obesity, many people are concerned with losing weight and keeping track of their body fat, thus measuring body composition has become popular in health and fitness facilities. A simple, fast and noninvasive method of monitoring adiposity, such as BIA, is needed by those that prescribe and monitor exercise. When using BIA technology, specific pretesting guidelines have been recommended in order to increase the accuracy of the measurements, including no exercise within 12 hours prior to the test [14]. This investigation examined the effect of two different exercise modalities (resistance and aerobic) on body composition determined by the relatively new MBIA technology. The primary finding of this investigation was that impedance and %BF measurements were significantly reduced following both 45 minutes of RE and AE in the men and women.

RE resulted in significant reductions in MBIA measured impedance (45Ω, 29Ω, and 28Ω) and %BF (1.6%). These findings are consistent with previous work that examined the effects of RE on single frequency (50 kHz) BIA. Dixon et al. [16] assessed eighty six recreationally active adults (45 women and 41 men) before and after a RE bout. Significant reductions in SBIA measured %BF (women 0.9%; men 1.4%), impedance (women 22.2Ω; men 22.3Ω), and fat mass (women 0.6kg; men 1.3kg) were observed following RE. In the present study, the reductions in the MBIA impedance at 50 kHz (29Ω) and %BF (1.6%) were slightly larger than those previously reported using

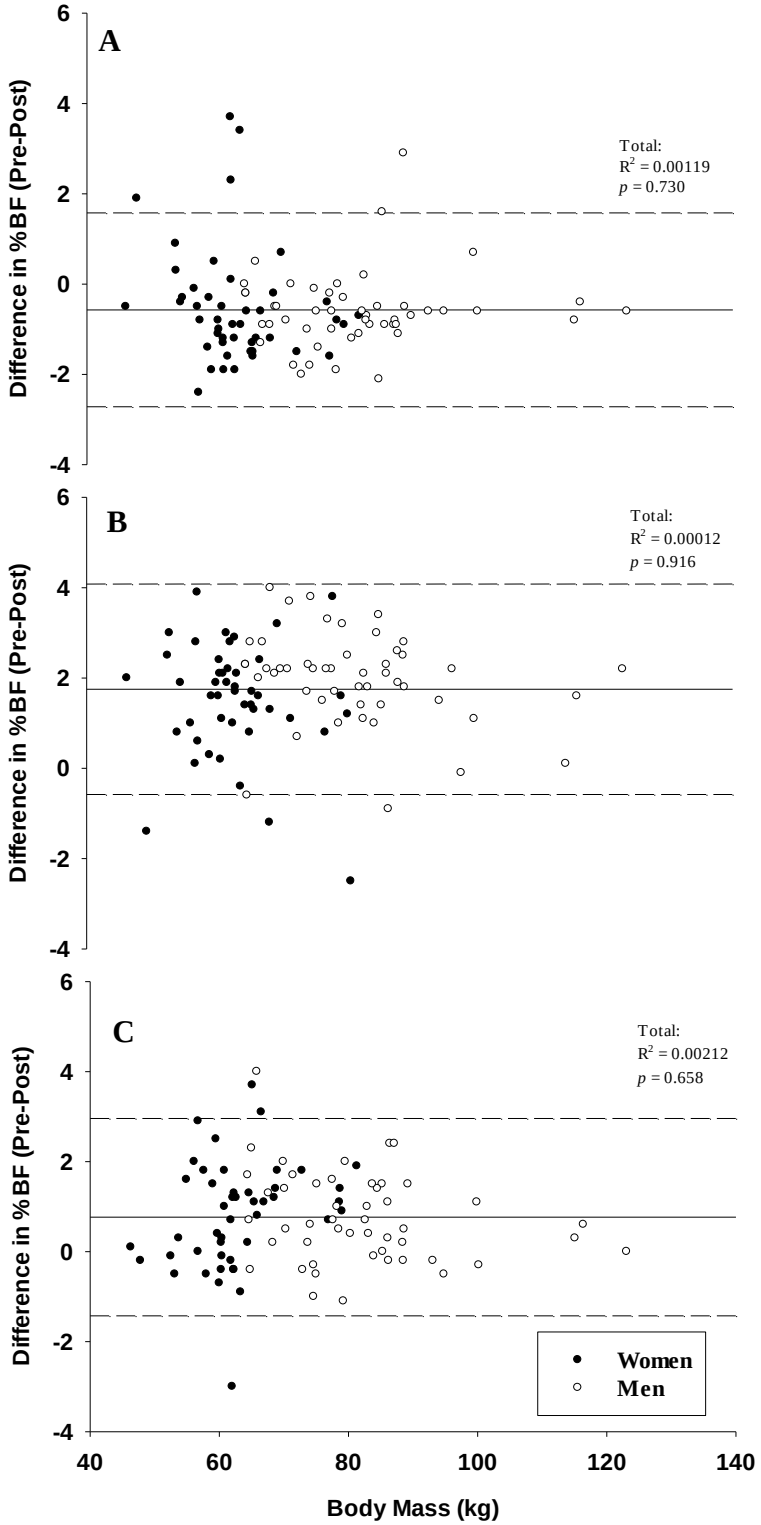


**Fig. 1 Scatter plots exploring individual differences between pre and post exercise %BF is plotted against body mass for women (●) and men (○); A) Control, B) Resistance Exercise, and C) Aerobic Exercise. Values greater than 0 indicate a %BF decrease from pre to post. The mean difference is represented by the solid line, and the dashed lines represent ± 2 SD from the mean.**

**Table 2 MBIA body composition measurements during all treatment conditions.**

| | Control | | Resistance | | Aerobic | |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post |
| Body Mass (kg) | 72.8 ±14.3 | 73.0 ±14.3* | 72.6 ±14.3 | 72.7 ±14.3* | 72.6 ±14.4 | 72.5 ±14.3* |
| Fat Free Mass (kg) | 57.9 ±12.6 | 57.6 ±12.6* | 58.1 ±12.6 | 58.8 ±12.8 | 58.1 ±12.6 | 58.5 ±12.6* |
| Fat Mass (kg) | 14.8 ±7.2 | 15.3 ±7.3* | 14.5 ±7.1 | 13.3 ±7.1* | 14.6 ±7.2 | 14.2 ±7.2* |
| Intracellular Water (kg) | 26.7 ±6.0 | 26.6 ±6.0 | 26.9 ±5.9 | 27.5 ±6.1* | 26.9 ±5.9 | 27.0 ±5.9* |
| Extracellular Water (kg) | 15.7 ±3.3 | 15.6 ±3.3* | 15.7 ±3.3 | 16.0 ±3.4* | 15.7 ±3.3 | 15.8 ±3.3* |
| Total Body Water (kg) | 42.4 ±9.2 | 42.2 ±9.3* | 42.6 ±9.3 | 43.6 ±9.5* | 42.6 ±9.2 | 42.9 ±9.3* |
| % Body Fat | 20.4 ±7.9 | 21.0 ±8.1* | 20.0 ±8.2 | 18.4 ±8.1* | 20.0 ±8.2 | 19.3 ±8.3* |
| 5 (Ohms) | 1272.7 ±181.0 | 1287.8 ±192.6* | 1279.4 ±184.6 | 1234.4 ±175.3* | 1279.6 ±187.8 | 1239.3 ±186.7* |
| 50 (Ohms) | 1099.8 ±176.7 | 1116.1 ±191.0* | 1106.1 ±182.5 | 1077.1 ±173.5* | 1101.1 ±185.2 | 1069.0 ±184.2* |
| 500 (Ohms) | 941.4 ±159.1 | 947.5 ±173.8 | 945.4 ±163.0 | 917.7 ±155.0* | 943.5 ±166.9 | 914.3 ±164.7* |

All values are mean ±SD. Pre = pre-exercise; Post = post-exercise, *$P < 0.05$ as compared to pretest.

SBIA technology [16] indicating that MBIA may be more sensitive to exercise-induced fluid alterations. When assessing body composition using the MBIA analyzer, it is apparent that resistance exercise results in %BF and impedance reductions post-exercise. These findings confirm that RE performed before MBIA assessment has a significant influence on body composition measurements, supporting the traditional bioelectrical impedance pretest exercise recommendations.

Similarly, AE significantly reduced MBIA measured impedance (40Ω, 32Ω, and 29Ω) at the 5, 50, and 500 kHz levels respectively, and %BF (0.7%). Previously, Dixon et al. [13] investigated the effects of AE on %BF in 63 college aged adults (31 women; 32 men). Similar reductions in LBIA and SBIA measured %BF estimates were observed in that study; LBIA: women 0.5%, men 1.6%; SBIA: women 1.0%, men 1.0%. Significant reductions in impedance at 50 kHz were also observed in LBIA (20Ω reduction in both women and men), and SBIA (19Ω and 18Ω; women and men, respectively). Andreacci et al. [12] examined the effects of cycle ergometry exercise on LBIA and SBIA-determined %BF estimates in 74 college aged adults (38 women; 36 men). Significant reductions in %BF (LBIA: 0.5%; SBIA: 1.0%) and impedance (LBIA: 2.9Ω; SBIA: 10.2Ω) were reported following 30 minutes of cycle ergometry at 70% $HR_{max}$. Although the MBIA %BF reduction observed presently was similar to those previously reported using LBIA and SBIA technology, the MBIA impedance reduction at 50 kHz, was much greater (32Ω) compared to the 20Ω (LBIA), and 19Ω (SBIA) reported by Dixon and colleagues [13]. The present study and that by Dixon et al. [13] reported larger alterations following exercise than Andreacci et al. [12] with 2.9Ω (LBIA) and 10.2Ω (SBIA). The variations in findings may be at least partially explained by differences in the mode (treadmill vs. cycle ergometry) and duration of exercise.

During the CON trial, significant increases were found in body mass (0.2 kg) and impedance (15.4Ω and 16.3Ω) at the 5 and 50 kHz levels, respectively. These findings support those by Dixon et al. [13, 16] and Andreacci et al. [12] who performed similar trials. Body mass, and impedance were shown to increase during the CON trial most likely due to fluid consumption.

Previous research has examined the effects of exercise on LBIA and SBIA analyzers, which measure impedance at a single frequency. MBIA use three different electrical frequencies (5, 50, and 500 kHz) enabling one to examine the impact of RE and AE exercise on the intra- and extracellular water values. In support of previous research, impedance and %BF values were reduced following exercise. The observed reduction can possibly be explained because of the fluid shift induced by exercise; increased

perfusion to the active muscle tissue during the exercise.

## 5. Conclusion

The findings in the present study, should benefit those currently assessing adiposity using MIBA technology in fitness-wellness centers, where it may be difficult and impractical for these people to adhere to stringent pretesting guidelines, prior to having their %BF assessed. Our findings indicate that the observed change in %BF, while statistically significant, may hold little practical significance in the field setting when assessed using MBIA technology. Therefore, restricting the client's exercise behavior prior to the assessment may not be needed, however these results may be more significant in a clinical setting. However, precision is critical, so MBIA assessments should be performed prior to exercise to eliminate potential exercise-induced alterations in body composition measurements, caused by fluid shifts. This information is important for coaches, personal trainers, athletic trainers, as well as other health and fitness professionals who may use this technology to monitor body composition in the field.

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# The Impact of the Techniques and Tactics Appropriate by the Athletes in Phase Triple Jump and Their Relationships with the Finale Results

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**Abstract:** The purposes of this study were to describe and compare the techniques used by elite world triple jumper and the Algerian elite team to determine the impact of distribution modality phases allowing the elite to exceeds 17-meter. Our subjects were two world elite 2009 and two Algerian national elite 2013. In the lack of new technology Modern measuring instruments kinematics or kinetics, our study based in measure of the Phase distribution ratio as measure of Stride length Jump distance. That literature review two schools, the Russian technique (which emphasizes the hop phase) and the Polish technique (which emphasizes the jump phase). Our aims for this study are: Are there any statistically significant differences between the results of the samples in the distance achieved? Are there any statistically significant differences between practical Ratio relative distances (world 2009-national 2013)? Are there any statistically significant differences between Stride length phase distances (world 2009-national 2013)? For that, we have chosen the analysis of variance and correlation of the distances achieved in each of the phases with the official distance of jumper and "T" student to compare implementation distribution of phases (hop, step and jump) with the results accuses. Based on the practices and weaknesses of elites in practice, we confirm: (1) All the samples practice the Russian technique as model in the distribution of the phase ratio; (2) The problem of our elites is in the hop phase distribution and its relationship with other phases; (3) Improve achieve horizontal vertical velocity in hop phase as solution.

**Key words:** The ratio phase, techniques, tactics appropriate, triple jump.

## 1. Introduction

The original triple jump as practiced by the Greeks was no more than three long jumps. The regulated triple jump was protected at the end of the XIX century, first by the Irish and then by the Americans [1].

The triple jump was inspired by the ancient Olympic Games and has been a modern Olympics event since the Games' inception in 1896. According to IAAF (International Association of Athletics Federations) rules, the hop shall be made so that an athlete lands first on the same foot as that from which he has taken off in the step, he shall land on the other foot, from which, subsequently, the jump is performed [2]. The current male and female world record holders are Jonathan Edwards of Great Britain, with a jump of 18.29 m (60 ft. 0 in), and Inessa Kravets of Ukraine, with a jump of 15.50 m (50 ft. 10 in). Both records were set during 1995 World Championships in Gothenburg.

The current record male Africa 17.37 m (56 ft. 113⁄4 in) by Tarik Bouguetaïb (MAR) and female is 15.39 m (50 ft. 53⁄4 in) Françoise Mbango Etone (CMR).

The best record of Algerian female is 14. 98 m (+ 0.2 m/s) By Baya Rahouli in Meeting Almeria 1 Juliet 2005 the best record of male Algerian is 16.92 m by Lotfi Khaïda Monaco Herculis games in August 7, 1993 [3].

The literature review reveals that the triple jump consists of a running approach, 3 take-off phases in which the athlete hops on one foot, lands on the same

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foot, steps onto the opposite foot, and finally jumps and lands in the sand pit [4].

The lengths of the three phases are typically about 39%, 30%, 31% of the total length of the jump for the Russian technique, and 35%, 29%, 36% of the total length for the Polish technique [5]. Allen et al. reported that the world record performances from 1911 to 1985 a move away from a hop-dominated technique with a small step phase (40-41%:22%:36-38%), towards a hop-dominated technique with a larger step phase (37-39%:28-30%:31-33%), and latterly towards a jump-dominated technique (34-35%:28-30%:36-37%) [6].

Hiu confirmed that Phase ratio is a measure of effort distribution in the triple jump [7]. Hop-dominant, balanced, and jump-dominant techniques were three triple jump techniques defined based on phase ratio.

For the reason that our elites does not exceed 17-meter, our goal is to introduce the biomechanics evaluation before explaining the reason scientific of the absence of the Algerian performance elite in world festivals by discussing the importance of maintaining the model distribution ratios applied in the outcome.

In addition, our research analyzed the performance of Algerian elites as first part and the second part was to compare their results with the world's elite 2009 to illustrate the importance of the good contribution of the phase jump on the results. Our motive is to highlight the biomechanical assessment for Algerian coaches to plan the choice of the right assessment technique to their athletes.

## 2. Material and Methods

For the purposes of analysis, we have calculated the distance of the hop phase (the distance of the hop), and step phase (the distance of the step), and the phase jump (the distance of the jump), in two-dimensional [8].

The analysis of the present study was with the software Kinovea, the capture and measured distance of each phase of triple jump as Fig.1.

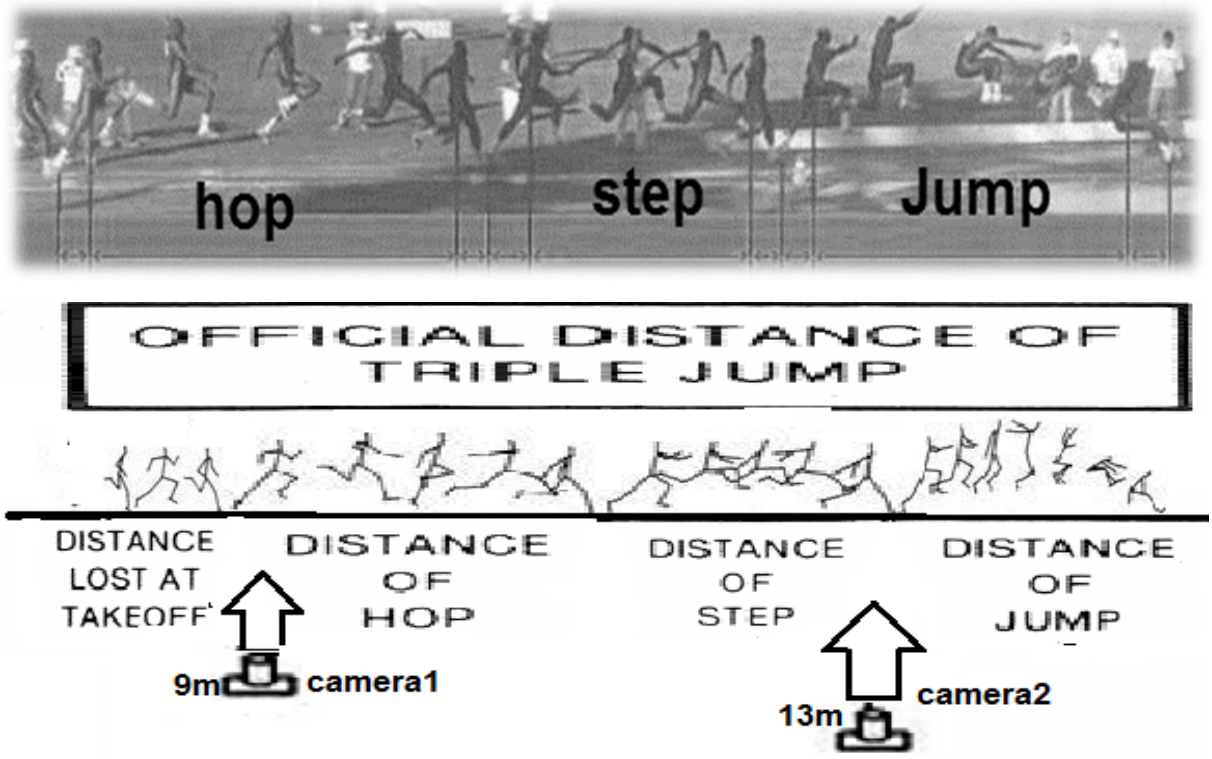


**Fig. 1 The method chosen to calculate the Distance of phase [9].**

Sites of the three cameras that depicting the distance triple jump

These cameras were placed at distances of 19.4 m and 22.1 m from the midline of the triple jump runway, with their optical axes at right angles to this line. The first camera was placed 0.9 m forward (or on the pit side) of the front edge of the board and was used to record the subjects' performances during the hop phase of the triple jump. The second camera was placed 13.0 m forward of the front edge of the board and was used to record performances during the step and jump phases [8]. To measure the real distance, a series of markers was placed in carefully measured locations along the inside, curb of the track between the runway and each camera. These markers served as reference measurement.

## 3. Data Collection

*3.1 Subjects*

The subjects were the two-world champions Berlin 2009 results from the German athletics federation [10] and for Algerian; we have made analyses of their performances in similar study [11].

*3.2 Data Reduction*

Our cameras were attached to our laptops to record directly into folders prepare in advance for each subject chosen for analysis. The distances of the analyses tests are shown in Table1 (a-b) for all the subjects and Table 1(b) for Algerian elite's team. With the software Kinovea, the films obtained for each test were phase analysis for each variable and participant.

*3.3 Data Analysis*

The data analysis procedures used in this study consisted of the computation of the means, standard deviations, the Pearson correlations and Independent Samples Test of all the variables identified in based of the theoretical model in the similar studies (Fig. 1).

## 4. Results

From Table 2, through the results of the paired T student and Pearson correlation at the 0.05 level (2-tailed) and Degrees of freedom (n-1) are not significant at the 0.01 level (2-tailed) in all comparisons except in the hop phase.

## 5. Conclusion

From this, we conclude that the tactics appropriate used by nationalist elements remain far from the level of application of the Champions world within this technique (which emphasizes the hop phase) in hop phase comparison.

**Table 1 (a-b) Description of The Acquired Results of Our Samples.**

| The Results (a) Champions World 2009 [10] | | | | |
|---|---|---|---|---|
| Variables | Real | Stride length (m) | | |
| | Distance | Hop | Step | Jump |
| World Champion | 17.92 | 6.49 | 5.41 | 6.02 |
| Vice World | 17.60 | 6.51 | 5.41 | 5.68 |
| Mean | 17.76 | 6.50 | 5.41 | 5.85 |
| SD | 0.23 | 0.01 | 0.00 | 0.24 |

| The Results (b) Algerian Champions 2013 after the kinematics analysis [11] | | | | |
|---|---|---|---|---|
| Variables | Real | Stride length (m) | | |
| | Distance | Hop | Step | Jump |
| Champion Algeria | 16.16 | 5.79 | 5.1 | 5.27 |
| Vice Champion | 16.15 | 5.72 | 5.02 | 5.41 |
| Mean | 16.16 | 5.76 | 5.06 | 5.34 |
| SD | 0.01 | 0.05 | 0.06 | 0.10 |

**Table 2 Deference statistical existed between the results of the samples obtained in the final distance.**

| variables | | Mean | SD | t | df | R | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Total distance | World | 17.76 | 0.23 | 10.36 | 01 | +1 | 0.06 |
| | Algerian | 16.16 | 0.01 | | | | |
| Hop | World | 6.50 | 0.014 | 16.56 | | -1 | 0.038 |
| | Algerian | 5.76 | 0.049 | | | | |
| Step | World | 5.41 | 0.00 | 8.87 | | +1 | 0.071 |
| | Algerian | 5.06 | 0.06 | | | | |
| Jump | World | 5.85 | 0.24 | 2.13 | | -1 | 0.280 |
| | Algerian | 5.34 | 0.09 | | | | |

**Table 3 The connectivity relationships between variables in order to study.**

| Correlations length phase distance for our samples | | | | |
|---|---|---|---|---|
| variables | | Hop | Step | Jump |
| Hop | Pearson Correlation | 1 | 0.995** | 0.869* |
| | Sig. (2-tailed) | | 0.005 | 0.131 |
| | N | 4 | 4 | 4 |
| Step | Pearson Correlation | 0.995** | 1 | 0.852* |
| | Sig. (2-tailed) | 0.005 | | 0.148 |
| | N | 4 | 4 | 4 |
| Jump | Pearson Correlation | 0.869* | 0.852* | 1 |
| | Sig. (2-tailed) | 0.131 | 0.148 | |
| | N | 4 | 4 | 4 |

** Correlation is significant at the 0.01 level (2-tailed).

From Table 3, through the results of correlations length phase distance for our samples at the 0.01 level (2-tailed) and degrees of freedom ($n$ = 4), the correlations is strong positive significant in all the comparisons except in the jump phase.

Since the differences are not statistically significant, all our samples practice the Russian technique (which emphasizes the hop phase).

From the Table 4 (a), through the results of the mean of the Ratio World Jumpers, we conclude that the dominant techniques is for the benefit of the Hop-dominated technique with a length of three phases are typically (36%, 31%, 33%). Based on the results obtained, we referred to the practice of the Russian technique (emphasizes the hop phase) [9, 12, 13].

Table 4 (b) shows the results of the correlations of the ratio based on the relative distance for our champion world. The simple correlation is significant positive at the 0.01 level (2-tailed) in all comparisons, except in the jump phase which is strong negative. From that, we confirm that the dominant techniques is in the benefit of the Hop-dominated. Based on the results obtained, we referred to the practice of the Russian technique (emphasizes the hop phase) [9, 12, 13].

Table 4 (c) shows the results of the mean of the Ratio Algerians Jumpers, and we conclude that the dominant techniques is for the benefit of the Hop-dominated technique

Table 4 (d) shows the results of the correlations of the ratio based on the relative distance of the Algerian Champion 2013, the simple correlation is significant positive at the 0.01 level (2-tailed) in all comparisons, except in the jump phase which is strong negative; we confirm that the dominant technique is in the benefit of the Hop-dominated. Based on the results obtained, we referred to the practice of the Russian technique (emphasizes the hop phase) [9, 12, 13].

Table 5 (a) shows the results of the Independent Samples Test for the Stride length phase distance between our champions (world-national), which is

**Table 4 (a) The practical ratio relative distance for the World Champion 2009.**

| (a) Champion World 2009 based on the relative distance (%) | | | | |
|---|---|---|---|---|
| Variables | Jump | Relative Distance (%) | | |
| | Distance (m) | Hop Ratio (%) | Step Ratio (%) | Jump Ratio (%) |
| World champion | 17.92 | 36.22 | 30.19 | 33.59 |
| Vice World | 17.60 | 36.99 | 30.74 | 32.27 |
| Mean | 16.96 | 36.60 | 30.46 | 32.93 |
| SD | 0.94 | 0.55 | 0.39 | 0.93 |

**Table 4 (b) The correlations on the relative distance phase for the World Champion 2009.**

| (b) Champion World 2009 correlations on the relative distance (%) | | | | |
|---|---|---|---|---|
| Variables | | Hop | Step | Jump |
| Hop | Pearson Correlation | 1 | 1** | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Step | Pearson Correlation | 1** | 1 | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Jump | Pearson Correlation | -1** | -1** | 1 |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |

** Correlation is significant at the 0.01 level (2-tailed).

**Table 4 (c) The practical ratio relative distance for the Algerian Champions 2013.**

| (c) Algerian Champions 2013 based on the relative distance (%) | | | | |
|---|---|---|---|---|
| Variables | Distance (m) | Hop ratio (%) | Step ratio (%) | Jump ratio (%) |
| World champion | 16.16 | 35.83 | 31.56 | 32.61 |
| Vice world | 16.15 | 35.42 | 31.08 | 33.50 |
| Mean | 16.155 | 35.62 | 31.32 | 33.05 |
| SD | 0.01 | 0.29 | 0.34 | 0.63 |

**Table 4 (d) The correlations on the relative distance phase for the Algerian Champion 2013.**

| (d) Algerian Champions 2013 correlations on the relative distance (%) | | | | |
|---|---|---|---|---|
| Variables | | Hop | Step | Jump |
| Hop | Pearson Correlation | 1 | 1** | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Step | Pearson Correlation | 1** | 1 | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Jump | Pearson Correlation | -1** | -1** | 1 |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |

** Correlation is significant at the 0.01 level (2-tailed).

significant at the 0.05 level (2-tailed) in all comparisons, except in jump phase. From that, we confirm the superiority hurt in the interest of world champions in phases (hop and step).

Table 5 (b) show the results of the correlations the Stride length phase distance between our champions (world-national), which is significant at the 0.01 level (2-tailed) in all comparisons, except in correlations

**Table 5 (a) Independent samples test of the stride length phase distance between our champions (world-national).**

| Independent Samples Test | | M | SD | T | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| Hop | World | 6.50 | 0.015 | 20.467 | 2 | 0.002 |
| | Algerian | 5.76 | 0.049 | | | |
| Step | World | 5.41 | 0.00 | 8.750 | | 0.013 |
| | Algerian | 5.06 | 0.056 | | | |
| Jump | World | 5.85 | 0.24 | 2.774 | | 0.109 |
| | Algerian | 5.34 | 0.099 | | | |

**Table 5 (b) Correlations of the stride length phase distance between our champions (world-national).**

| (b) Correlations the Stride length phase distance | | | | |
|---|---|---|---|---|
| variables | | Hop ALG | Step ALG | Jump ALG |
| Hop CW | Pearson Correlation | -1** | -1** | 1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Step CW | Pearson Correlation | 1** | 1** | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |
| Jump CW | Pearson Correlation | 1** | 1** | -1** |
| | Sig. (2-tailed) | | | |
| | N | 2 | 2 | 2 |

** Correlation is significant at the 0.01 level (2-tailed).

phase (hop (CW)*hop (Alg), hop (CW)* step (ALG),step(CW)*jump(ALG) and jump (CW)-jump (ALG)). Based on the synthesis of Ed Jacoby [14] , the triple jump good coach understands that good mechanics in the transition phases leads to a good performance and that any error in any phase will be related to another. For this reason, we confirm that the strength of our world champions is in the correct practice of this technique that requires good mechanical and physical control in the transition between phases.

## 6. Discussion

The study showed that the Russian technique (which emphasizes the hop phase) most used by our samples was the technique hop. The most difference between the world champions and our elites are in hop phase. Paul [15] explained the objective of this phase is to achieve horizontal vertical velocity (going forward and up) of the takeoff board, not vertical horizontal velocity (up and forward as in the long jump) and any change should minimally in the step phase change the angular momentum created by hop [16].

For our research, we explain that difference in the level of optimum phase practiced by our champion world in the transition of the advantage hop phase that any error in achieve horizontal vertical velocity are related in the other phases. For that, we advise our coach and their elites the recommendation of K. Dziewiecki, Z. Mazur [17] . The phase's ratios distances must be learned measured and practiced as effort distribution in their techniques (Hop-dominant, balanced, and jump-dominant). The technique is based on phase ratio [7] and the improving final speed horizontal ideal for the athlete [6] and condition and not to lose control of the technique and influence in achievement

## 7. Conclusion

From the purposes of this study, we recommend our coaches and their athletes the mean most used in assessment in the triple jump, because the phase ratio allows us not only to measure the effort distribution in

the triple jump but also define the techniques and errors of practice. The comparisons guide us to determine the technique practiced and weaknesses of our elites in practice.

Our results and recommendations:

1. All the samples practice the Russian technique as model in the distribution of the phase ratio.

2. The problem of our elites is in the hop phase distribution and its relationship with other phases.

3. Improve achieve horizontal vertical velocity in hop phase as solution.

Our aims:

For the national elites and their technical steps:

Using the biomechanics to determine the errors practice in models theoretical.

Integrated the modern scientific methods into the program monitoring sports.

Respect the modality distribution of efforts in Russian technique to improve the performances.

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# Olympic Movement or Diplomatic Movement? The Role of Olympic Games on Development of International Relations

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**Abstract:** The Olympic Charter is categorized into three main sections: the IOC (International Olympic Committee), the IFs (International Federations) and NOCs (National Olympic Committees). Since the 1980s, the prominent functions of sport and in particular mega events such as the Olympic Games have been deeply analyzed by academic and political writers. Sporting mega events like the Olympic Games can produce lots of advantages: international branding and prestige, economic development, unity and cooperation, cultural exchanges and interactions, reduction in political isolation and sanctions, and so on. One of the most important legacies of Olympic Games for the host country/city is social cohesion, national pride and patriotism. For example, the success of Iran in the London 2012 Olympics resulted in heightened cultural identity and national prestige. Despite political and economic isolation resulting from international sanctions, Iranian athletes and coaches overcame obstacles to win four Olympic gold medals in "Mega Media Event" that is the summer Olympic Games. The present study demonstrates the interconnections between success in the Olympic Games and the development of nations. The data to support the analysis and arguments were gathered through public documents and interviews with sport diplomacy experts. At first, we investigated some international functions for sport, then we had 13 interviews with 11 Iranian and 2 foreign experts who had international positions in different sport organizations like IOC, Ifs, FIFA (Federation international the Football Association) and OCA (Olympic council of Asia). Finally, all information was organized into the following factors: enhancing international branding and prestige, international image, number of sport tourists as virtual industry in new millennium, national cohesion and identity, national patriotism, peacefulness, cultural exchanges among nations and reduce political boycotts and economic sanctions.

**Key words**: Olympic, International Relations, Iran.

## 1. Introduction

Public diplomacy is a new diplomatic studies area. Fisher describes public diplomacy as the result of three components: cultural exchanges, cultural diplomacy, and media casting. Because of the intersecting phenomenon of international sporting events—which traverses cultural exchanges, diplomacy and transnational organizations, and the prevalence and influence of the mass media on sport—international sport can play an important role in the entire public-private continuum at any point [1]. Fused together, sport diplomacy create a hybrid concept, "sport diplomacy", which has a critical role in diplomatic history [2].

For centuries, sport has been a vital part of community and nation building and its relationship with the political sphere (especially diplomacy) has a long tradition of cooperation and synergy. Although sport diplomacy as a sub-branch of public diplomacy has attracted much attention in recent years, the relationship goes back to the 9th century BC. The kings signed an "Olympic Truth" during the first festival of the ancient Olympic Games. They agreed to

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suspend all violent and hostile behaviors by the time of the event to provide enjoyment for audiences and athletes. The relationship between sport and diplomacy has been reinforced over time, and the "Olympic Truth" continues to serve as a reminder of the importance of sport diplomacy throughout the twentieth century (which saw unparalleled growth in global media and international sport) and increasingly so in the new millennium where ideas, politics, culture, and sport impact and influence international relations [2].

In fact, it may now be impractical to separate the concepts of sport diplomacy and public diplomacy, as sport becomes increasingly a vehicle for economic development, political agendas, and governments' diplomatic tactics. Diplomatic efforts are often facilitated by traditional diplomacy, the use of sporting events and even athletes (as celebrities and national icons), and the articulation of national goals that shape foreign policy and relations and are integrated with (even overlapping) transnational sporting and political organizations. Thus, sport can be deployed as a tool of and for diplomacy cutting across national, cultural, non-governmental, and media spheres. Fig.1 indicates the level of awareness toward and elements associated with sport diplomacy through the 2010 London Olympic Games:

Although traditional diplomacy has been designed to achieve diplomatic goals, Murray identifies seven reasons for articulating the sport diplomacy concept [3].

Changes in diplomacy space lead to tying sport and diplomacy together. Sport is an indirect tool to achieve foreign policy objectives. The image of a country's foreign policy can be shaped by the use, presence, or absence of sport and influences outside perception of a nation as closed, isolated, open, or popular.

Sport and its associated institutions are on the rise across cultural and national consciousness—imbricated with economic and social power, cultural influence, and even people's identities. As global media and sport, David Beckham has stated "No one is opposed to sport; sport has an international quality and it's kind of epidemic".

The public are tired of widespread violence in the new millennium. Consequently, diplomats and political leaders often use soft power such as cultural and sport exchanges to resolve their conflicts. In the postmodern age, sport and culture are powerful tools of foreign policy and transcend the more traditional boundaries of international relations.

Sport has a global audience and is a huge part of quotidian life. If the pictures and diplomatic messages transmitted through positive sport values have influence, then perceptions of nations can be improved

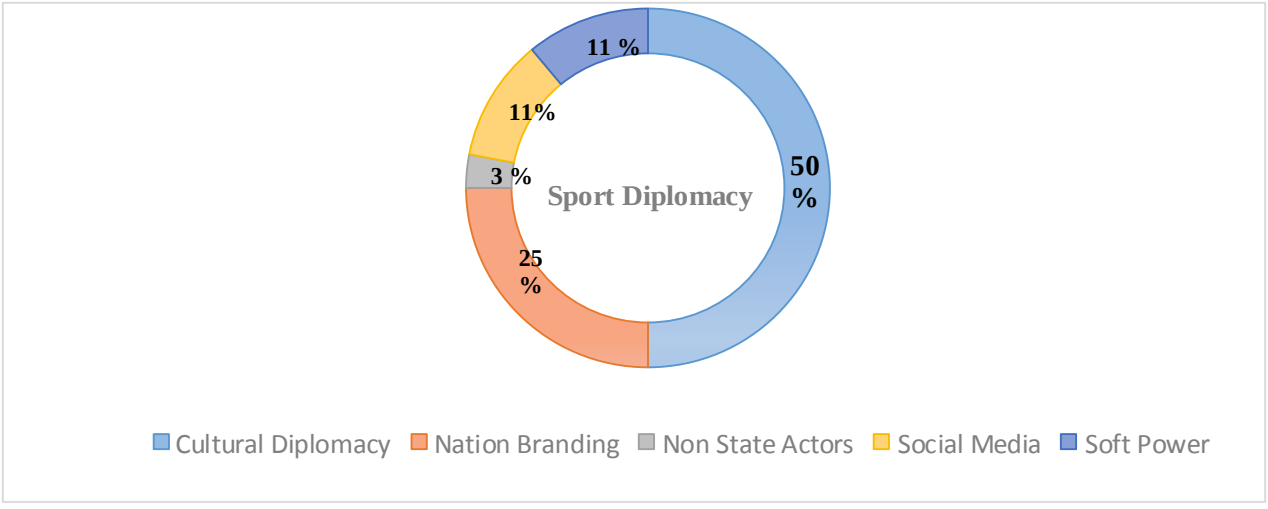


**Fig. 1 Released papers about different parts of sport diplomacy.**

and the strategies of foreign policy changed. For instance, the Beijing 2008 Summer Olympic Games provided an opportunity for China to introduce itself as an economy, culture, and people to an international community.

Convergence and increasing proximity of sport and diplomacy to each other. Jim Cain, former U.S. ambassador to Denmark, observes "Sports can be a powerful tool for achieving the relationships among the governments". Sport carries a positive message in the context of common values such as mutual respect, tolerance, compassion, discipline. These values, in turn, can positively influence the presence of racism, the experience of xenophobia, and bridge cultural and political divisions. In this way, sport can support and extend effective foreign policy toward oriented toward positive international relations. After Black September (September 11, 2011), USA applied sport as a way to attract Muslim youth in Africa and the Middle East. Sport provided a vehicle for the US to connect with people across broad national, ethnic, and religious difference. This tactic reinforced, across even disparate tribal and ethnic groups, commonalities and orientations toward human rights and mutual respect. Thus, while respecting differences in language, local traditions, customs, etc., the use of sport reinforces a more universal experience and a space for intercultural contact and awareness.

Globalization is another reason and resource to interact and integrate diplomacy and sport together. As Markovits and Rensmann note "political campaigning, governing, and symbolic politics often entail references to sport", perhaps this is so because athletes and politicians travel in a space of public awareness focused on each group's roles and responsibilities within cultural and political spheres. Consequently, sport and diplomacy are drawn toward each other like magnets—each having their force but often attracted to one another via their import and influence on citizens, voters, and consumers. Perhaps the affinity is primordial—both the athlete and the diplomat compete is races where winning and losing is eminently observable and measurable and the drama draws an audience irrespective of the competition's locale—racing oval or meeting room table [4].

Lastly, sport diplomacy provides a soft path to reveal a significant change in a nation's foreign policy agenda. The best example of this is perhaps the Ping Pong diplomacy between China and the US in 1971 or, more recently, the 2011 if cricket diplomacy between India and Pakistan, where Gilani (Pakistan Prime Minister) invited his Hindi counterpart Singh to attend and watch the semifinal match of cricket world cup in south Asian countries [3].

Over the past three decades, hosting sport mega events (like the summer or winter Olympics or the FIFA World Cup) has emerged as a prominent political phenomenon and it is one of the emerging economic resources for governments [5]. The mega events are important in the international arena—they provide a venue for global public attention and create a powerful platform for a nation desiring to articulate a particular image of itself (as developed, cosmopolitan, friendly, safe, etc.). Mega events have many determinant features like: the increased number of tourists, trade, reputation of host city/country in the world, and the development of infrastructure in the host country/city [6]. Numerous studies in relation to each of terms "Mega Event", "Major Event", "Hallmark Event", "Wide Scale Event" and "Special Event" were presented. By considering all these definitions, the term "Mega" is different due to effect of event on host city/country [2]. Politicians run the political processes at community and influence large non-governmental organizations such as the IOC or FIFA [7].

The Olympic Games, as an example of a huge cultural event, reminds us the potential for "Sport Diplomacy". The IOC prepared an appropriate space for gathering disparate nations in a calm place and remove conflicts and governmental enmity. This happens by athletic heroism, the competitive spirit,

and the values of the Olympic charter even for a short period of time [8]. The concept of "Olympic Diplomacy" has two main vectors: the first one is the intrinsic value of sport, even if experience in the transient manner of a match or competition, for diplomatic dialogue and safe space for competition between nations. The other is that sport can highlight the space of conflict and facilitate friendship or very visibly offer an opportunity for protest. The reaction of many nations to the Soviet invasion to Afghanistan in December 1979 and subsequent boycott is but one example where a mega event, and the attention is draws globally, serves as a space for nations to articulate the state of their diplomatic relations [3].

*1.1 Media Roles, International Relations and Sport*

The increase presence and value television are interconnected with the Olympic Games, each influencing each other in the mutual goal of generating larger audiences and more revenue. Technological advances in the mass media have enabled the Olympic Games to become more accessible to audiences throughout the globe. While the IOC sees the media broadcasting rights as the main source of its revenue, sport is the most important source programming, from a commercial perspective, for the media [9]. The Rome 1960 Summer Olympic Games was the first the time television broadcast Olympic events live casting. In the fifty years since then, media conglomerates have competed for the broadcasting rights, with the costs spiraling upward from the slightly more than $1.2 million paid in 1960 to over one billion dollars spent on recent broadcasting rights. The introduction of broadcasting provided a brilliant opportunity for home audiences to watch games like the stadium spectators and to expand the fan experience—redefining the Olympics as global mega event. People in 18 countries, including Japan, Canada and USA watched those 1960 Olympic Games. Shariati Feizabadi explained the number of territories covered by Olympic Games in Table 1 [10].

Since the 1984 Los Angeles, broadcasting rights have exploded and their relevance and import has reinforced and grown the Olympic Games—there is now a symbiosis between broadcasters and the Olympics. This in turn has fueled greater opportunities for sponsorship and associated revenue, driven ticket sales (thought this uneven), created larger opportunities for merchandising, and encouraged competition for hosting the games because of the perception of prestige and direct or indirect benefits of having millions of people come to the host city and billions able to see the host city through their televisions and computer screens. Indeed the commercialization of the Olympics has grown dramatically since the 1984 summer games and the IOC has seen the opportunity to increase sponsorships and the expansion of broadcast rights sales. One of the beneficial outcomes for political, community, and economic boosters within a host city is the potential for investment and development of infrastructure to secure hosting rights as the scale of the event has grown.

**Table 1 Number of territories covered by Olympic broadcasting.**

| Year | Host | No. of Territories | Year | Host | No. of Territories |
|---|---|---|---|---|---|
| 1980 | Moscow | 11 | 1936 | Berlin | 1 |
| 1984 | Los Angeles | 156 | 1948 | London | 1 |
| 1988 | Seoul | 160 | 1952 | Helsinki | 2 |
| 1992 | Barcelona | 193 | 1956 | Melbourne | 1 |
| 1996 | Atlanta | 214 | 1960 | Rome | 21 |
| 2000 | Sydney | 220 | 1964 | Tokyo | 40 |
| 2004 | Athena | 220 | 1968 | Mexico city | Na |
| 2008 | Beijing | 220 | 1972 | Munich | 98 |
| 2012 | London | 220 | 1976 | Montreal | 124 |

Thus local leaders can often secure private and public investment in projects, while other local sectors related to tourism and hospitality profit from sponsors, tourists, and ticket sales [12].

During this period of expansion of the broadcasting and commercialization, there has been a growth in the territories and region where the games are covered. The Sydney 2000 Olympic Games were the first to broadcast to 220 different countries and regions. On the other hand, Beijing 2008 Summer Olympic Games was the first fully digital games in the world's biggest sport event history that 63% of the global population (4.3 out of 6.7 billion people) had access to watch the games live. This tournament was the biggest "Media Event" in the world [10].

*1.2 Sport Functions in International Relations*

Across the historical place of sport, today sport has become the focal point of community.

Bainvel summarized the functions of sport in the following [13]:

A tool for promotion of power and domination
A phenomenon to strengthen political ideology
A tool to destroy peacefulness
A way for provoking enmities
A tool to estimate and out graded nations
A tool for damaging the neutralized relations
A tool for revenge
Kind of easy business
A way to hide doping
A tool for tampering
A tool for racism
A tool for physical and verbal violence
A way to increase patriotism
A tool for integrating the minorities and tribes
Contributing tool for peace
A tool for encouraging the nationalism
A way to improve international relations
A way for strengthening peacefulness
A tool for nation's friendship
A way for increasing tolerance and kindness
A tool for reducing conflicts
A way for creating chivalry spirit
A tool for analyzing an especial
A way for explaining the opposes situation

*1.3 International Branding, Prestige and Image*

Sport is a way to influence the image of a nation, and producing what is called "Soft Power" or "Social Capital". The foundational elements of public diplomacy are listening or engaging a foreign public by collecting and analyzing its opinions and feeding that to the formation of policy; Advocacy through direct representation of information and policy; cultural diplomacy through the participation in and facilitated export of culture exchange; diplomacy as the mutual exchanges of personnel with foreign partner; international broadcasting engaging foreign audiences through direct delivery of news. All these elements, which Joseph Nye famously labeled as "Soft Power," work together with policies and cultural values of society [23].This is especially true for newly founded countries that are faced with financial constraints and where sport can be a precious alternative for other symbolic or raw materials [2]. "National Branding" is a new form of public diplomacy among the countries where sport is the easiest way to achieve that goal [14]. Sport as national brand can facilitate governments in their pursuit of achieving their commercial or political goals [2]. For instance, "Sport Nation" was one of the Australian images before, during and after Sydney 2000 Summer Olympic Games. According to Australian tourist Commission report, the successful outcome of Games leaded to improving Australia's image as much as 10 years, and it shows the correct management of image by organizers [14].

*1.4 Sport Tourism: "Virtual Industry" in New Millennium*

Besides cultural and archaeological tourism, many tourism attraction types have come into existence and

addressed broader segments of tourists across the world, including recreational tourism, beaches tourism, religious tourism, therapeutic tourism, eco-tourism, sports tourism, golf tourism, safari tourism, desert tourism, yacht tourism, and maritime tourism in addition to festivals tourism, and cultural events and finally conferences and exhibitions tourism. Sport tourism can be seen as like the fine arts and theater: players are akin to artists, spectators become the audience, and stadiums are the theaters [15]. Small countries can benefit from hosting sport events proportionally. The Cook Islands, with a population of 13,000, are near New Zealand and hosted 100 thousand tourisms annually. Over the past decade, the islands have several projects for the construction of sport facilities and infrastructures such as 3000-seat national stadium. The islands hosted "Pacific Mini Games" where 22 islands competed in 15 sport disciplines. The other sport event was "World Youth Netball" championship where 20 countries participated in those games. These islands have hosted the "Bowl" tournament in 2009. It was one of the seventh major events in rugby field that resulted in 34500 tourists to islands [1].

*1.5 Sport, National Identity, Cohesion and Patriotism*

Sport is frequently a vehicle for the expression of nationalist sentiment to the extent that politicians are all too willing to harness it for such disparate, even unethical purposes as nation building, promoting the nation or giving cultural power to separatist movements [24]. The integrative role of sport for a nation is similar to its structured functional role that can be been found in classical and social science studies. Sport can allow for local, regional, or even national differences and still provide a space to deal with diversity, racism, tribal and regional conflicts within a country. Indeed, this safe zone for disparate peoples to come together is a central reason that causes people to participate in sport events and, on a larger scale, undergirds the value of the Olympic movement [16]. For example, a country tried to employ players from other nationalities to use sport as a national pride tool. As Qatar did by employing Bulgaria's weightlifters [8]. As former IOC president Avery Brundage[1] has stated "Sport as well as music and fine arts can be paled the political and ethnical boundaries; we can stay together through sport, and politic or business never be realized this cohesion, lonely" [8].

*1.6 Sport, Political Boycotts and Economic Sanctions*

Isolation and sanctions can be placed in the context of development. Politicians and policy makers talked about "political development" phenomenon at first, then the economists, sociologists and political scientists focused on the importance role of policy. The collocation "political development" has a precise definition. This refers to several studies from the perspective of inter disciplinary studies of "growth", "modernization" and "development" in the Third World [17].

Sport as an arena for diplomatic strife arena can occur, and isolation and global development are the double-edged sword of sport. The cold war opponents boycotted each other's games in 1980 and 1984. USA plus 64 other countries boycotted Moscow 1980 Summer Olympic Games because of Soviet invasion to Afghanistan. This led to only 80 countries participating in those games. Since 1956, this was the lowest number of nations in the Olympic Games. On the other hand, Soviet Union and 14 other countries from East Bloc (except Romania) refused to participate in 1984 Los Angeles with the excuse of unsafety [18].

*1.7 Sport and Its Peacefulness Role*

Many authors have suggested that sport has potential to reduce tension among competitors in international arena, and it can integrate diversity and inequality in a country. Regardless of language, race,

[1] Former President of IOC during 1952-72

ideology or culture, sport is capable to gather all people for creating and exciting humanitarian scene. For instance, Olympic rings symbolized the five continents and its white flag represent purity [19].

Sport cannot impose or maintain peace, but it can inspire it. Sport has a vital role to play as it continues to demonstrate that it can facilitate dialogue between different communities and be a catalyst for mutual understanding in global society [24].

*1.8 Sport Fields: An Arena for Cultural Exchanges*

Many experts talk about the common aspects of cultural relations and sport diplomacy, however, we can clarify this similarity by exploring some indicators. For example, cultural relations between nations and their peoples can be facilitated by political structuring of offices and ministries. A nation could create a special organization with the task of implementing strategy that could include establishing cultural centers, friendship associations, scientific and academic cooperation, cooperation between Radio and TV, sports, tourism and the other kinds of cultural activities that can be helpful both to economic development and easing international tensions by encouraging contact and understanding [20]. Sport can therefore be a part of a government's public diplomacy strategy. Although sport is not the only form of diplomacy, it is an important part of cultural diplomacy (along with food, education, science, etc.) [8]. As compared to the other types of cultural exchanges like science, language, art and so on, sport is a vital part of cultural soft power which bring greater unity and national cohesion and expand a nation's space in the international sphere of diplomacy and relations [14].

It might properly be said that sport is "schizophrenic" because of its association with frivolous or leisure activity and its very serious role in terms of domestic and international politics. For sure people with different interest utilize sport for amusement and to pass the time, but it has also been part of important diplomatic positions (for example, the ping pong diplomacy between the US and China, 1980 Summer Olympics boycott; and, in an anticipatory vein, the 2022 Qatar World Cup). From our vantage point, sport ought to be considered as a suitable basis for presenting culture and encouraging positive international relations. Although some people believe that sport should be kept clean and free from political issue, perhaps it is better consider it as a part of political life and a tool for diplomacy [8].

*1.9 International Sport Organizations*

International society has many diverse organizations that operate in different contexts. The global society without international organizations and mutually international organizations without global society never substantialize each other, there needs to be structure to connect and facilitate the work of both elements. International organizations are a significant reason for global solidarity and an effective means for international diplomacy and the pursuit of more perfect solutions among nations as they seek to make effective decisions in and for the world [21].

Sajjadi categorized the sport international organizations into two main categories [20]:

(1) IOC (International Olympic Committee);

(2) IFs (International Sport Federations).

The Olympic movement includes the IOC and the hundreds of NOCs (National Olympic Committees). As well within sports and events associated with the Olympics, there are international federations, and the OCOGs (Organizational Committee of the Games), as well as national associations and clubs that are parts of this huge executive sport organization [16].

Mega events like the Summer Olympic Games, Asian Games and the other kinds of hallmark events play a critical role in placing a city or country on a global map. Increasing the number of tourists and the associated increase in revenue, as well as the increased reputation of host country and host city, are the most important advantages that provoke a

government to support hosting. As the largest and most popular global event, the Olympic Games play an important role in developing and expanding international communications. The Olympic Games have a critical impact on national pride. Different countries, by investing on this mega event, try to maintain and develop their national pride by presenting themselves on a world stage [13].

Of course, the Olympic Games are not the only tool or opportunity for such building an international profile. The OCA is the most important sport organization in Asia which holds Summer Asian Games every four years. In addition to the biggest continental event, it is in charge of some other events [1]: (1) Asian Winter Games; (2) Asian Indoor Games; (3) Asian Beach Games; (4) Asian Martial—Art Games; (5) AYG (Asian Youth Games).

Likewise, FIFA plays a critical role in international relations. A giant organization with 209 members (more than United Nations Organization), FIFA was founded by seven European footballing nations in 1904. The story of this growth, first at a continental level and then moving into its transcontinental reality, is that association football itself was coterminous with the rise of industrial society and nations and now associated with the transnational reality of media and multinational corporate sponsorships [25].

## 2. Conclusion

The first question that we need to ask ourselves before explaining how to get involved with diplomacy is: What actually constitutes diplomacy? Public diplomacy is, at its core, the sharing of diplomatic messages between political entities that improve the relationship between nations. Public diplomacy was used as a vehicle to promote nation's soft power for winning the Cold War. In this space, sport is an ideal vehicle, capable of fomenting a domestic and perhaps even international collective culture and a safe space for nations to countries symbolize their prowess and challenge each other. By sending delegations of athletes abroad, nations can promulgate international relations through a foundation built upon sporting exchanges and related tourism. Correspondingly, the suspension of a proposed sport visit to another nation can be used by states as means to safely engage in public conflict with specific government and its policy makers.

The significance of the phenomenon of sport is not inherent but manifests itself in the uses to which it is put in society. In fact, sport symbolizes the international environment while also being a pragmatic tool of that environment. Its manifold uses serve a variety interests in international relations, a usefulness that can only increase as the effect of sport becomes more widely recognized and understood. The additional presence and symbiosis with the mass media will simply enhance the centrality and import of sport to diplomacy in the new millennium.

Currently, the ability of a country or international actor to present an appropriate and attractive image, via sport, to the international community can provide great opportunities for political and economic development. On the other hand, ignoring this fact can lead to a country's isolation.

Increased international attention to soft power and public diplomacy can be considered the most important component of creating positive image in international society. Sport organizations as main actors of NGOs can promote or decreased the image of a nation. Even the impact for a city awarded hosting rights for the Summer Olympic Games is considerable, as people admire their ability to be successful actors across different political, social, economy and cultural domains. Further elevation to the IOC or FIFA can serve as a kind of verification sign for a nation's importance or superiority. All in all, the assumption that mega events such as the Summer Olympic Games are good for states and their citizens rests on a number of conjectures that also serve as an event's legacy. The most five prominent legacies are:

(1) Success of elite athletes can inspire most of

youth to take part in sport to improve their healthiness;

(2) In comparison with the other forms of tourism, Olympic Games are economically lucrative and bringing a huge revenue for hosting nation/city;

(3) Olympic Games engendered a "feel cool" factor among citizens of the host nation;

(4) Urban and rural regeneration accelerated;

(5) Nations benefits by casting themselves internationally that introduce their culture and pursue national interest in international relations.

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# Wrestling: Glory of India at the Olympics—A Brief History of Indian Wresting Team in the Olympic Games

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**Abstract:** Wrestling as an Olympic sport has been around since the dawn of modern Olympic games and India is a participating nation in it. Wrestling has unique position among Olympic disciplines in India, from being provider of first individual medal to newly independent nation to lately becoming most significant contributor in medal tally. This coming of age of Indian wrestling team with double medal tally in the last Olympics has been outcome of long and steady journey of Indian wrestling team over a period of 40-50 years and numerous Summer Olympic Games. However, this journey of Indian wrestling team in the Olympics is also a story of significant twist and turn, near misses and also of glory. So this article covers the entire saga of Indian wrestlers at highest sporting event of world—Olympic Games, from inception of first Indian team of mere three grapplers to latest Olympics with debut of first Indian female grappler in Olympic arena. This history is written by sweat and hard work of Indian grapplers with its own highs and lows.

**Key words:** Indian wrestling team, the Olympics, wrestlers of India in Olympic Games, freestyle and Greco Roman Wrestling.

## 1. Introduction

As a participating nation, India has a long history in the modern Olympic Games with debut of Indian contingent in 2nd Olympic Games organized at Paris in 1900. After a gap, India has registered its continuous presence in the games since 1920 Olympics[1] and Indian Wrestling Team also has remained important part of the nation's Olympic delegation. Till now, India as a nation has 26 medals at the Olympics to its credit, majority being in team event of Field Hockey with 11 different medals, leading the whole world in this sport. However, when it comes to individual events, it is the Wrestling Team of India which has set many records in Olympic History of the nation. Wrestling gave the first individual medal of independent India at 1952 Olympics[2] and brought feeling of pride, honour and hope not only for the newly established republic, in comity of nations, but also to the millions toiling under colonialism in third world countries. Wrestling along with shooting, as a discipline, share the second highest number of medal haul in the Olympics for India. Along with this Wrestling as a sport is only discipline, in India, which gave double Olympic medalist for the nation. Not only has wrestling registered its presence on medal tally of India at the Olympics in an impressive fashion, but also there are numerous instances of dominance of Indian Wrestling Team in the Olympics with many near miss opportunities. Hence the exploits of the Indian Wrestling Team at the various Olympics are worth analysis to understand the current direction of Sports in the nation and also to predict the future trends and pattern.

## 2. The Beginning

The sojourn of Indian Wrestling Team at the Olympics initiated from the 1920 Olympics[3] itself where two member steam represented India. Out of two disciplines in which the new nation participated, Wrestling was one of main event apart from Athletics.

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[1]Organized at Antwerp, Belgium

[2]Ibid

[3]Organized at London, the UK

This team comprised of Kumar Navale and Randhir Shindes in middleweight[4] and featherweight[5] categories respectively. This debut of Indian Wrestling Team was indeed impressive as wrestler Randhir Shindes not only reached up to semifinal but also on his way defeated a famous Great Britain wrestler of that time, Henry Inman in quarter final. This was a great feat given that India was under colonial British Raj and its people were held to be inferior to British lot. However, after going down in semifinal, Randhir Shindes could only secure 4th Rank in final tally. Despite being one step short of a podium finish, this debut Indian Wrestling Team laid a proper foundation to the India's Olympic dream which encouraged and inspired the coming generations of wrestlers and sportspersons in the nation.

### *2.1 First Wrestling Team of India as Sovereign Nation in the Olympics*

After a log gap, the next Olympics for Indian wrestlers came in 1948[6], in the post war era when for the first time India participated as an independent nation. The new nation sent 6 members strong team for a of total 8 weight disciplines in freestyle category. This team had future stalwart of Indian wrestling, K.D. Jadhav, a boy only of 21 years in a new weight category introduced as Fly Weight. He was best performer of team and stood 6 in final standings of his weight category, after being defeated by much senior Iran's M. Raisi, who stood 4th.

However, the other members of 1948 Wrestling Team were not that impressive in their performance. Most of team went down in 2nd round of elimination, Nirmal Bose in Bantam Weight, S. Suryavanshi in Feather Weight, Banta Singh in Light Weight and Keshav Roy in Middle Weight. Only Anant Bhargava in Welter Weight reached 3rd round but still he failed to get a final ranking. Another important feature worth noticing here is that there is lack of representation in higher weight categories by Indians and also in Greco-Roman Style. Despite all this, the Indian Wrestling Team had made its presence felt.

## 3. The First Podium Finish, 1952 Olympic Games

The 1952 Olympic Games[7] have a special significance in general as well as from perspective of India. These games witnessed a paradigm shift with the coming of Soviet Union and other East European players in competition. This entry of Soviet Union in the games was most profoundly felt in Wrestling Discipline as they come to dominate this sports right from beginning. In this background, India sent 4 members strong team with K. D. Jadhav as senior of the earlier Olympic Games. This Indian Wrestling Team had dream run and had rendezvous with history.

Out of total 4 wrestlers in this team, one came very close to podium finish, Keshav D. Mangawai in freestyle Featherweight category securing 4th position, while his other teammate, K. D. Jadhav made history by becoming first Indian individual to win a medal at the Olympics. The gravity of this achievement can be gauged by the fact that for matching this feat by an Indian, it took 44 long years and 11 editions of the Olympics. Thus in this edition of the Olympic Games, Indian Wrestling Team achieved a hall mark which was no thought of earlier.

This staller performance by Mr K. D. Jadhav needs to bit explained. After migrating to higher Bantam weight category[8] from earlier Fly weight[9], Jadhav had to face tough pool with 6 rounds to cross before final round. In first two rounds, Jadhav defeated his Canadian and Mexican opponents, decisively by fall, respectively. In 3rd Round, Jadhav met tough opponent Schmitz whom he defeated by 2-1 difference of points.

The final round came down to Japan's Shohachi Ishii, Soviet Azerbaijani Rashid Mamedbekov, and Indian K. D. Jadhav. Mamedbekov had beaten Jhadav in round

[4]Up to 75 kg
[5]Up to 60 kg being lightest Weight category in 1920 Olympics.
[6]Organized at London, the UK
[7]Organized at Helsinki, Finland
[8]57 kg
[9]52kg

five, so Ishii fought Jhadav in the first final match, winning by unanimous decision. Ishii then defeated Mamedbekov, also by unanimous decision, to win the gold medal, with the Soviet taking silver. However, despite his loss in final round, it was by his stupendous performance that Indian wrestler impressed the wrestling fraternity of world and entered into annals of the Olympic Games history and that of a proud nation.

## 4. The Period of Long Wait 1956-2004

*4.1 Stage of Ascendency 1956-1976*

In next edition of the summer Olympics[10] in 1956, India sent 5 members contingent; however it failed to make the mark. None of wrestlers get beyond 3rd round and hence failed to secure final ranking. However, the situation changed in next summer games[11] as India Wrestling Team performed better. The commendable performer of this team in Freestyle category were MadhoSingh contesting in Middle Weight securing 5th position, Sajan Singh got 7th position in Light Heavy Weight. Uday Chand and Gian Prakash got 14th and 15th position in Welter and Light Weight categories, respectively.

The 1964 Summer Olympic Games[12] were special for India as well as other Asian countries, as these were organized for first time in Asian Continent. India sent 7 members strong Wrestling Team for various weight categories. However, except Bishamber Singh in Bantam Weight category who secured 6th rank, nobody could get any ranking, failing majorly in 2nd or 3rd round. However, this edition of the Olympic game witnessed the first participation by Indian Wrestlers in Greco-Roman Style. Mostly, the freestyle wrestlers of India participated in Greco-Roman category also and India was represented in 5 different weight categories of Greco-Roman Style, highest till now, though none succeeded beyond elimination round.

The Indian Wrestling Team in 1968 Olympic Games[13] achieved a unique feat, as its Light Weight Freestyle Wrestler Uday Chand went on to represent India in three consequent Summer Olympic Games of 1960, 1964 and 1968 at age of 33 years. In his last Olympics, Uday Chand gave his best and got 6th Rank. Apart from him another wrestler in Freestyle Light Weight Category, Sudesh Kumar achieved same position in ranking, but he failed during elimination round in same weight category at Greco-Roman event. Their other team mates failed to get a ranking position after failing in elimination rounds.

Munich Olympics[14] though has been infamous for terrorist attack, witnessed the strong performance of Indian Wrestlers in different weight categories. It has been especially a close call for two Indian grapplers Sudesh Kumar and surprisingly young 17 years old Prem Nath, both of them missing podium finish by whisker and ending as 4th in their respective weight categories.

The senior of two, Sudesh Kumar using his previous Olympic experience performed well in his Fly Weight category, and remained unbeaten till final round, winning his all but one bout by fall. However, in last round, he was beaten by eventual Gold and Silver Medalists in closely contested matches. The young 17 years old Prem Nath had dream run in Bantam Weight, winning all his bouts in decisively. In end, he was defeated by mature USA wrestler Rich Sanders who was silver medalist in 1968 and also in 1972 Olympics. For Bronze medal, Prem Nath was unlucky, as he lost it on basis of bad points rather than a bout. He had more bad points than the 3rd adjudged Hungarian Wrestler, hence another close miss for medal hope.

In 1976 Olympics[15]Indian Wrestling Team did not participate and it was only Olympics since 1948 where no Indian grappler took part. However, 1980's decade saw strong performance by Indian wrestlers in the Olympic arena.

[10]Organised at Melbourne, Australia
[11] 1960 Summer Olympics were organized at Rome, Italy
[12]Organised at Tokyo, Japan
[13]Organised at Mexico City, Mexico
[14] 1972 Summer Olympics were organized at Munich, Germany.
[15]Organised at Montreal, Canada

*4.2 The Stage of Plateau 1980-1992*

In 1980[16] Olympics among the 5 member team, two finished in top 6 positions. In Lightweight Freestyle Jagminder Singh displayed splendid wrestling and reached till 5th round and finally placed at 4th Rank, missing podium finish. Likewise in Welterweight Freestyle category, Rajinder Singh had dominant performance but been unlucky in third round when he lost to Italian Wrestler on criteria basis despite having tie in score. Eventually Rajinder Singh was placed 6th in his weight category.

The Los Angeles Olympics[17] were interesting as USSR (Union of Soviet Socialist Republics) led East Bloc countries boycotted the games and hence competition in Wrestling was comparatively eased than previous editions. India entered one of most experienced team and was considered strong contenders for medals in wrestling, which was also proved by performance of its wrestlers. India participated in most of Freestyle Weight categories and out of these 4 of its wrestler got into final ranking bracket.

The best performer was Welterweight wrestler Rajinder Singh who reached up to final round and been placed 4th after losing to eventual silver and bronze medalist of his weight. But Rajinder Singh was first Indian wrestler since K. D. Jadhav to improve upon his performance in subsequent Olympics and finishing in ranking table, despite that fact that Singh could not repeat feat of Jadhav. Similarly, Rohtas Singh in Bantamweight got 5th rank in final standing, Mahavir Singh got 6th Rank in Flyweight category and Kartar Singh got 7th rank in Heavyweight category which was also best performance for an Indian wrestler in this particular weight category.

The Seoul Olympics[18] saw a team of 4 Indian wrestlers competing in different weight categories of Freestyle event. However, none of team members could get beyond the elimination rounds and hence could not get final ranking. Kartar Singh in Heavyweight Category became the 2nd Indian wrestler to participate in three consequent Olympics, that is, 1980, 1984 and 1988, after Uday Chand in 1960's.

The 1992 Olympic Games[19] were also unique for Indian Wrestling Team for two main events. One of them was the performance on PappuYadav in Light Fly Weight of Greco-Roman Category, in which after long gap since 1968, an Indian participated and that too secured decent 8th rank. Along with that Subash Verma in Heavyweight of Freestyle category landed 6th Rank, improving over that of his team mate same category in last edition of the Games. These events are significant as Indian Wrestlers were now venturing into areas earlier not touched upon like Greco-Roman style and heavier weight categories of Freestyle.

*4.3 Stage of Decline 1996-2000*

In Atlanta Olympics[20] lone Indian grappler was Pappu Yadav, who now migrated to higher weight category of Flyweight in Greco-Roman style of wrestling. However, he could not repeat his performance and got 17th rank tied with another grappler. Similar situation continued in next edition of Summer Olympics in 2000[21] where lone Indian Wrestler representing India was Gurbinder Singh in Lightweight category of Greco-Roman Style, finishing at low rank of 13th. These two editions of games saw the nadir of this sport in Olympic History of India. However, things took dramatic turn since then onwards for better and better.

The Athens Olympic Games[22] proved to be another watershed in history of Wrestling at Olympics, as it saw the introduction of women events for first since 1904 Olympics and also that too for India, as it saw the debut of rising Indian wrestler who later made India proud by putting India again in medal tally of wrestling

[16] Organised at Moscow, erstwhile USSR
[17] 1984
[18] 1988
[19] Organized at Barcelona, Spain
[20] 1996
[21] Organized at Sydney, Australia
[22] 2004

at Olympics. Indian wrestling team was comprised of total 7 wrestlers, one in Greco-Roman and six in Freestyle. The best performance in this team was that of Ramesh Kumar in Men's Welterweight category, where he secured 10th rank. However, it was the experience gained by young wrestlers of 21 years of age both, namely Yogeshwar Dutt and Sushil Kumar in Featherweight and Lightweight categories of Freestyle, respectively, that proved crucial for golden performance by these grapplers in later edition of the Olympic Games. Another first for Indian Wrestling Team at the Olympics was the entry of Palwinder Singh Cheema in Super Heavyweight[23] category of Freestyle as this weight category was untouched by Indian wrestlers prior to that, though he finished 15th in final ranking yet this was a feat for Indian Wrestling Team.

## 5. The Golden Era of Indian wrestling in the Olympics 2008-onwards

### *5.1 Repeat of History and Second Ever Medal in Wrestling 2008*

The new dawn of Indian wrestling came up unexpectedly in 2008 Olympics[24] when the long draught of medals was quenched and in fact new flood gates were opened. Post these games, wrestling became a household name and it drew huge public as well as institutional support to Indian Wrestlers which went on to reshape the map of wrestling in India and manifested into more stellar performance by Indian Wrestlers in next Olympics.

In 2008, India sent a small contingent of three wrestlers; two experienced Yogeshwar Dutt in Men's Lightweight[25] Category and Sushil Kumar in Welterweight[26] Category, along with Rajeev Tomar in Super Heavyweight[27]. It is worth discussing about the format of these freestyle competitions in the 2008 Olympics. This freestyle wrestling competition consisted of a single-elimination tournament, with a repechage[28] used to determine the winner of two bronze medals. The two finalists faced off for gold and silver medals. Each wrestler who lost to one of the two finalists moved into the repechage, culminating in a pair of bronze medal matches featuring the semifinal losers each facing the remaining repechage opponent from their half of the bracket. Each bout consisted of up to three rounds, lasting two minutes apiece. The wrestler who scored more points in each round was the winner of that rounds; the bout finished when one wrestler had won two rounds (and thus the match).

Unfortunately for India, its Super Heavyweight grappler was ousted in round one of competition itself. In Men's Lightweight category, Dutt gave sturdy performance, after getting bye in initial round, he outclassed his Kazak competitor in dominant way. However, in quarterfinals, he met Japanese wrestler and both had a closely contested bout. After winning first round, Dutt conceded the second round to his competitor and it came to final and penultimate round. In this decisive final round, the Indian wrestler again seized the initiative early, going ahead 1-0 but failed to hold on to the lead in the last 10 seconds and gave away two match winning points to his opponent to lose 2-1. And in semifinal, this Japanese Wrestler lost out to eventual silver medalist Ukrainian Wrestler, closing even the possibility of a chance for Dutt in repechage round. This dented the moral of not only the individual but whole Indian Team.

However, the journey of Sushil Kumar in 2008 Olympics is albeit full of twist and turns which can even motivate a commercial sports thriller. He not only created history by equating the feat of K. D. Jadhav[29], grand old man of Indian Wrestling at Olympics after 56 years by bagging bronze medal but also rewritten the

[23] 120kg
[24] Organized at Beijing, China
[25] 60kg
[26] 66kg
[27] See supra note 23

[28] Repechage means literally "fishing out, rescuing" and is a practice in series competitions that allows participants who failed to meet qualifying standards by a small margin to continue to the next round.
[29] Wrestling Bronze Medalist in Helsinki Olympics 1952

chronicles of Indian Wrestling for all the time to come by repeating his feat in next Olympics with improvement in metal of his medal to silver. This elevation of Kumar into history books is in fact manifestation of coming of age of Indian Wrestling Traditions at international arena, seeds of which were sown long ago.

After getting a bye to the 1/8 round, Kumar lost to Ukrainian Wrestler A. Stadnikin the first round of the 66 kg freestyle wrestling event in straight two rounds leaving, his medal hopes hinging on the repechage round, provided that Ukrainian wrestler reaches final. Stadnik reached in final round providing a chance to Kumar at repechage. There Kumar defeated American Doug Schwab, who was 5th in last world championships in which Kumar was seventh, in the first repechage round and Belarusian Albert Batyrov in the second repechage round. In the bronze medal match on 20 August 2008, Kumar faced the tough opponent Kazak wrestler L. Spiridonov, who reached up to semifinal round and there losing to finalist A. Stadnik.

This bronze medal match was so intense and had proved to harbinger of a positive change to Indian wrestling which nobody could have thought. In first round, Kumar got better of his opponent by score of 2-1 in close contest between both wrestlers. In second round, however, Kazak wrestler beat Kumar with score of 0-1. It came down to decisive final round and a hallowed medal of the Olympics at stake. Within stipulated time of 2 minutes, none of wrestler could score a point and match went on to be decided by a technique called clinch rule. In this scenario, one of the wrestlers is randomly chosen to take his opponent's leg for a final 30 seconds that decides the round. The positions are chosen at random by the official. He uses a bag containing two balls—one red, one blue; each representing a wrestler. The ball that is pulled by the official decides which wrestler starts in the offensive position. Even in this case, luck run out on Sushil and his opponent won the draw thus Kazak wrestler was in better position.

However, as it is said in folklores fortune favors the bold, Indian wrestler brought his opponent down from a seemingly disadvantaged position and winning this round with 2-0 score in his favor and thus bronze medal of the Olympics and an assured position in history books.

### *5.2 The First Ever Double Medal Haul for Indian Wrestling 2012*

The latest 30th Olympic Games in London[30] saw the zenith of Indian Wrestling Team where it returned with two Olympic medals, rare first in Indian sports that too of different colors-one silver and one bronze. And Sushil Kumar became first sports person to achieve distinct feat of being first sportsperson to achieve double Olympic medal. Along with that, in Geeta Phogat India found its first women grappler to compete in Olympics.

In London Olympic Games, India sent a team of 5 wrestlers, one woman and rest men in Freestyle category. Out of these, Geeta Phogat secured 13th rank in Women Lightweight category and become first woman wrestler from India to compete at Olympics since inception of woman wrestling events in 2004 Olympics onwards. Other two young wrestlers, Amit Kumar and Narsingh P. Yadav secured 10th and 13th ranks in Men's Featherweight and Middleweight, respectively.

It was feat of two veterans[31] Yogeshwar Dutt and Sushil Kumar which took wrestling to its peak in this edition of Olympic Games. Competing in Men's Lightweight Freestyle category, Dutt defeated Bulgarian wrestler in Qualification round in three rounds. But he got defeated by eventual Silver medalist Russian B. Kudukhov in second round, allowing an attempt in repechage round. Dutt's performance in repechage round was decisive in all three rounds. In first round, he dismissed the Puerto Rican wrestler in straight two rounds. In second round, he dispatched

[30] In 2012
[31] Both played in three Olympics 2004, 2008 and 2012

then Junior world and Asian champion and promising wrestler of Iran Masoud Esmaeilpour in closely contested match with score of 0-3-4 in his favour, coming from behind. In final bronze medal match, again coming from behind, Dutt defeated North Korean wrestler Ri Jong-myoung with score of 0-1-6 in favour of Dutt. In final round of this bronze medal match, he out classed his opponent with full minute remaining by scoring straight 6 points to his opponents none. This was India's third Bronze Medal at Olympics in Wrestling.

Sushil Kumar's journey to maiden Olympic Finals, in Men's Welterweight Freestyle category, for that matter, first by any Indian Wrestler, is rather manifestation of dominance now been associated with Indian Wrestling Team at international events including at the Olympics. After getting a bye in first round, Kumar sent packing then defending Olympic Champion Ramazan Sahin[32] of Turkey in second round itself. In quarterfinals, Kumar defeated the Uzbek wrestler in tough three rounds match. The semifinal was also keenly contested bout between Indian and Kazak Wrestler A. Tanatarov. First period was won by Kumar in dominant way with score of 3-0 in his favour. However, second period was won by Kazak wrestler with similar score line. This led to the final round of bout being decisive as both wrestlers were at tie after winning one round each. In this final round, Sushil got better of his opponent in last minute of contest as he was rallying behind by 3 points during initial duration. Thus he won this semifinal with amazing display of writ and willpower. And with a final score of 3-6 in his favour, he entered the Olympic final, first for any Indian Wrestler ever.

In final, however, Sushil Kumar suffering from fatigue and possible food poisoning lost to Japanese Wrestler in straight two rounds and settled for the Silver Medal. This is 4th medal of Indian Wrestling Team ever and only 2nd individual Silver medal[33] for India ever at Olympics till date.

## 6. Conclusion

Thus there are few things that become apparent on analysis of history of Indian Wrestling Team in Olympics. It is beyond doubt that Freestyle Wrestling has been backbone of India at the Olympic Games as compared to Greco-Roman Style of Wrestling. Though there been a presence of Indian wrestler in Greco-Roman Style at Olympics but largely it has been nominal in nature. It is the Freestyle Wrestling which is deeply rooted in cultural fabric of Indian society especially in its northern and western region that has produced numerous formidable competitors of this sport at Olympics for India.

Another factor which distinguishes Wrestling as Olympic sports in India Sporting History is its long and continuous presence at numerous the Olympic Games. Apart from sports like Hockey, none other discipline can boast of such long and strong presence in Indian Contingent at various Olympic Venues. However, the sheer tally of medals in wrestling discipline is low if we compare it in proportion to the players competing at the Olympics for India. But when we take into account the closely missed chances and stellar performance by various Indian grapplers at the Olympics then, it would be safe to say that no other sports in India, especially, in individual category has displayed such formidable performance at this highest sporting platform. Indian Wrestlers are now better off under severe levels of stress and anxiety to perform well at highest levels mainly on account of new found success of their colleagues at the Olympics. It has been proven too as a positive impact on mental toughness of Indian Wrestlers.

Hence this journey of Indian Wrestling Team at Olympics will continue and it is expected to get rich haul of medals for nation in coming games. As now especially the current generation of wrestlers in India

[32]2008 Beijing Gold Medalist in Men's Welterweight Freestyle category

[33]First Silver Medal for India was won by Maj. Rajyavardhan Singh Rathore in Men's Double Trap Shooting at 2004 Athens Olympic Games.

has seen first-hand experience of converting opportunities into medals, as for previous generations, the medals were eluding for long gap. Hope this good harvest of medals by Indian grappler continues for time to come in annals of the Olympic Games.

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