

The 4th International Sport Science Symposium on “Sport Sciences for the Promotion of Active Life”

【Poster Presentation / Project III】

Sport Sciences, 8, 111-139, 2011

Accepted for publication: 7 March 2011

### **The analysis of postural control ability in athletes with rotational motion**

Haruo Iwata<sup>1</sup>, Hiroki Nakata<sup>2</sup>, Kai Kobayashi<sup>2</sup>, Yusuke Uchida<sup>2</sup>, Keiko Momose<sup>3</sup>, Kazuyuki Kanosue<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University,

<sup>3</sup>Faculty of Human Sciences, Waseda University

Figure skate, ballet dance and contest dance are sports including rotational motion. Athletes in these sports are required postural control in order to perform under the rotational stimulation. The better they adapt to the rotational stimulation, the better they can perform, particularly, right after a rotational movement. The purpose of this study is to investigate how athletes can adapt to rotational stimulation. Subjects sit in a computerized rotary chair and experience repeated rotations for forty seconds. During the rotation the subjects opened their eyes with or without an adaptational skill called “spotting”, or closed their eyes. Immediately

after the stimulation, they maintain upright posture with their eyes opened. The head movement and smooth-pursuit component of eye movement after the end of rotation are smaller in the expert group than in the control group both with eyes open and closed. In addition, when the “spotting” skill was used, the head and eye movements became even smaller. A dancer gazes at one point till when it becomes impossible, and then quickly rotates the head back so that the same point could be seen again. It seems that dancers are adapted to rotation not only physiologically but also with special skill.

## Alterations of skin immunity after high-intensity endurance exercise

Nobuhiko Eda<sup>1</sup>, Sumihito Horiuchi<sup>2</sup>, Kazuhiro Shimizu<sup>3</sup>, Satomi Suzuki<sup>1</sup>, Keisuke Nokura<sup>1</sup>, Yoko Tanabe<sup>1,4</sup>,  
Eunjae Lee<sup>1</sup>, Takao Akama<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>School of Sport Sciences, Waseda University,  
<sup>3</sup>Faculty of Sport Sciences, Waseda University, <sup>4</sup>College of law, Nihon University

In the previous study, we suggested that high-intensity endurance exercise might depress skin immune function and increase infectious risk on skin surface. The aim of this study was to determine the alterations of skin immunity without taking a shower after high-intensity endurance exercise, especially secretory immunoglobulin A (SIgA) on skin surface. Seven healthy adult males participated in this study. Each of the participants performed bicycle exercise at 75%HRmax for 60 min (18:30 p.m.-19:30 p.m.). Skin surface samples were collected at 18:25 p.m.(A), 19:35 p.m.(B), 20:30 p.m.(C), and 21:30 p.m.(D). SIgA was obtained from 1 ml extraction liquids stirred with the microtube homogenizer in the polypropylene

tube for 60 sec on middle of chest and medial side of the forearm. Staphylococci were harvested by pressed agar-based media composed of Tellurite-glycine-salt-egg yolk (TGSE) against the skin surface on middle of chest and medial side of the forearm. SIgA concentrations were significantly lower at B, C, and D than at A ( $p < 0.01$ ) on middle of chest, and tended to be lower at C than at A ( $p = 0.056$ ) on medial side of the forearm. Numbers of staphylococci showed no significant differences. In this study, we couldn't confirm the effects of taking a shower after exercise. However, these results suggested that high-intensity endurance exercise might depress immune function on skin surface, as well as the previous study.

## **The influence of body weight and fat free mass on resting energy expenditure in male Japanese collegiate athletes**

Satomi Oshima<sup>1</sup>, Sakiho Miyauchi<sup>1</sup>, Suguru Torii<sup>2</sup>, Mitsuru Higuchi<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The purpose of this study was to clarify the influence of body weight (BW) and fat free mass (FFM) on resting energy expenditure (REE) and the prospect of predicting REE for male Japanese athletes. Thirty six collegiate male athletes participated in this study measuring REE by indirect calorimetry and body composition by dual x-ray absorptiometry (DXA). The athletes were divided into three groups based on their BW such as : Small-size (S)(64.1±3.3kg), Medium-size (M) (73.2±2.2kg), and Large-size (L) (82.0±3.6kg). The measured REE significantly correlated with both BW and FFM (BW;  $r=0.85$ ,  $P<0.001$ , FFM;

$r=0.81$ ,  $P<0.001$ ). The measured REE increased in accordance with increase in BW (S: 1576±135, M: 1780±104, and L 1920±121 kcal/day). The two commonly used REE prediction equations in Japan, which use BW or FFM, were significantly correlated with measured REE (BW:  $r=0.814$ ,  $P<0.001$ , FFM:  $r=0.815$ ,  $P<0.001$ ). However, the difference between REEm and REEe becomes bigger as BW increases for both equations. In conclusion, REE has strong relationship with both BW and FFM in male Japanese athletes. Both BW and FFM can be used to estimate REE, however it becomes less accurate as BW increases.

## The risk factors of lumbar intervertebral disc degeneration in collegiate rugby players

Satoru Otsuka<sup>1</sup>, Osamu Yanagisawa<sup>2</sup>, Mika Hangai<sup>3</sup>, Chie Sekine<sup>1</sup>, Koji Kaneoka<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University,

<sup>3</sup>Department of Orthopaedic Surgery, Showa General Hospital

<Purpose> The purpose of this study was to demonstrate the relationship between lumbar alignment and muscular size, and lumbar intervertebral disc degeneration(LIDD) by magnetic resonance(MR) images. <Methods> Midsagittal T<sub>2</sub> images of lumbar spine and midtransversal T<sub>1</sub> images were obtained from 28 collegiate rugby players using 1.5-tesla MR device. The lumbo-sacral angle (LSA) and lumbo-lordotic angle (LLA) were used for the evaluation of lumbar alignment by T<sub>2</sub> images. The bilateral cross sectional area of rectus abdominis, external oblique, internal oblique, transversus abdominus, back muscles, iliopsoas and quadratus lumborum were calculated from T<sub>1</sub> images at L4-L5 level by the Osiris 4.19. Statistical analyses were performed by

the students t-test comparing degenerated players and non-degenerated players (p<0.05). <Results & Discussions> LSA and LLA were 33.8±5.7°and 39.0±6.6°on degenerated players and 31.4±6.0°and 35.8±7.9°on non-degenerated players. There were no significant differences of LSA and LLA between two groups. It showed a similar tendency to previous study (Hangai M et al 2009). The cross sectional area of each muscles in the two groups also did not show significant difference. <Conclusion>

There were no significant relationship to lumbar-lordotic alignment, trunk muscular size and LIDD between degenerated players and non-degenerated players in collegiate rugby players.

## Heart-capturing (Kandoh) scenes in sports

Daichi Oshimi<sup>1</sup>, Munehiko Harada<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

In this study aims to (1) develop a scale for measuring specific aspects of scenes that evoke sports spectators' Kandoh, (2) investigate gender differences with respect to such scenes, and (3) examine the impact of such scenes on spectators' satisfaction and intentions to attend future games. The word Kandoh refers to a positive emotional state arising from emotive experiences. As a result, an initial scale measuring eight aspects of Kandoh scenes (sympathy/togetherness, spectating in a stadium, dramatic scenes, outstanding play, strenuous figures, humanity, success from overcoming barriers, and additional elements) was

developed. After confirming that the scale was a good fit ( $\chi^2/df = 2.579$ , GFI = .869, AGFI = .835, CFI = .923, RMSEA = .065) and that its convergent validity and reliability were good (Cronbach's  $\alpha = .75 - .89$ , AVE = .85 - .95), we clarified the existence of a gender gap with respect to Kandoh scenes (spectating in a stadium, outstanding play, strenuous figures, humanity, success from overcoming barriers ) by a t-test, and some Kandoh scenes influenced spectators' satisfaction and future intention. These findings are valuable while considering the emotional aspects of spectators and may aid future sports marketing.

**The effects of passive static stretching and contract-relax proprioceptive neuromuscular facilitation stretching on muscle fascicle length, pennation angle and tendon elongation during passive joint rotation**

Eunsung Kim<sup>1</sup>, Ayumi Yoshikawa<sup>1</sup>, Yasuyoshi Mogi<sup>1</sup>, Atsuki Fukutani<sup>1</sup>, Naokazu Miyamoto<sup>2</sup>, Taku Wakahara<sup>2</sup>, Yasuo Kawakami<sup>2</sup>, Toshimasa Yanai<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The aim of the present study was to examine the effects of passive static (PS) stretching and contract-relax proprioceptive neuromuscular facilitation (CRPNF) stretching on muscle fascicle length, pennation angle and tendon elongation during passive joint rotation. Seven subjects participated in the two stretching interventions. The PS stretching consisted of four repetitions of 20 degrees ankle joint dorsiflexion for 30 s. The CRPNF stretching consisted of four repetitions of three phases; (1) maximal voluntary contraction of plantar flexion at the neutral ankle position for 5 s, (2) relaxation for 10 s at the neutral ankle position, and (3) 20 degrees ankle joint dorsiflexion for 30 s. The fascicle length and pennation angle of MG and

elongation of the Achilles tendon were measured during passive dorsiflexion with ultrasonography. The pennation angle during passive joint rotation was significantly different between the PS and CRPNF ( $p < .01$ ). The elongation of Achilles tendon exhibited passive joint rotation was found significantly different ( $p < .01$ ) between the PS ( $11.25 \pm 4.24$  mm) and CRPNF ( $9.34 \pm 3.7$  mm) stretching. On the other hand, the fascicle length and passive torque did not differ significantly from each other in the PS and CRPNF. These results demonstrate that PS and CRPNF stretching interventions have different influences on the pennation angle and Achilles tendon elongation during passive ankle dorsiflexion.

## **A longitudinal perspective of the relationship between perceived motivational climate and goal orientations among Japanese high school ice hockey players**

Homare Saotome<sup>1</sup>, Kazuhiro Harada<sup>1,2</sup>, Yoshio Nakamura<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Japan Society for the Promotion of Science,

<sup>3</sup>Faculty of Sport Sciences, Waseda University

**PURPOSE:** The purpose of this study was 1) to examine the relationship between perceived motivational climate created by coaches and goal orientations over time among Japanese high school ice hockey players, 2) to investigate how late-season goal orientation may vary. **METHODS:** One hundred and sixty-one players completed a series of surveys two times over the course of their athletic season. The first survey (T1) was conducted approximately three months before the interscholastic athletic competition. The second survey (T2) was conducted two months after T1. Among research items, the dependent variable was goal orientations (task orientation or ego orientation) at T2. The independent variables included goal orientations at T1 and perceived motivational climate (Task-Involving or Ego-Involving) at T2. Hierarchical multiple regression analysis was conducted. Subsequently,

ANOVA was conducted to determine whether changes would occur in players' goal orientations. **RESULTS:** Task orientation at T1 ( $\beta=.28$ ,  $p<.001$ ) and Task-Involving climate ( $\beta=.57$ ,  $p<.001$ ) positively predicted task orientation at T2. Our findings revealed that ego orientation at T1 ( $\beta=.41$ ,  $p<.001$ ) and Task-Involving climate ( $\beta=.38$ ,  $p<.001$ ) positively associated with ego orientation at T2. ANOVA revealed that incompatible groups (e.g. high task-orientation/low task-involving climate) showed a significant vary in goal orientation from T1 to T2.

**CONCLUSIONS:** These results demonstrated that the task-involving climate created by coaches alone influence players' goal orientations. Therefore, coaches may be able to create positive environments that can increase athletes' level of motivation and skill development.

## Preparatory movements during the pre-planned running turn with and without body rotation

Takahiko Sato<sup>1</sup>, Toshimasa Yanai<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The purpose of this study was to describe the preparatory movements exhibited during pre-planned running turn with and without body rotation. The eight subjects were asked to perform a 30° open turn to the left with and without body rotation (WR and WOR). A motion capture system was used to determine the three-dimensional coordinates of the reflective markers attached to each subject. The center of mass of whole body was estimated by using body segment inertial parameter reported by Ae et al. (1992), and its velocity on horizontal plane was computed. The angular momentum of whole body about the center of mass was determined by the method described by Dapena (1978) and its vertical component was used for analysis. No differences were found in the magnitude (WR: 5.0±0.2m/s; WOR: 5.1±0.1m/s) and the direction (WR: 7.6±2.5°; WOR: 5.3±2.7°)

of the horizontal velocity of the center of mass. The angular momentum of the body in WR before touch-down ( $0.8\pm0.8\text{kg}\cdot\text{m}^2/\text{s}$ ) was significantly larger than that in WOR ( $0.1\pm0.6\text{kg}\cdot\text{m}^2/\text{s}$ ) and than zero. The magnitude of change in the angular momentum during the stance phase (WR:  $-0.4\pm1.3\text{kg}\cdot\text{m}^2/\text{s}$ ; WOR:  $0.0\pm0.7\text{kg}\cdot\text{m}^2/\text{s}$ ) were not significantly different from zero. These results indicate that the angular momentum required for the body rotation was attained before the touch-down of the open turn and maintained during the stance phase. The findings of the present study demonstrated that preparatory movement for pre-planned running turn did not appear in the motion of the center of mass but it appeared in the form of angular motion of the whole body about the vertical axis.

**Effect of the dominant leg and pivot leg and foot posture  
on the star excursion balance test**

Manabu Sanomura<sup>1</sup>, Toru Fukubayashi<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The aim of this study is to examine the effect of the dominant leg and pivot leg and foot posture on the star excursion balance test (SEBT). The subjects were 40 healthy college students. The SEBT was performed in 3 directions (anterior, posteromedial, and posterolateral), and the foot posture was determined using the navicular drop test (NDT) score. The dominant leg was defined as the leg with which the subject preferred to kick a ball, and the other leg was defined as the pivot leg. On comparing the performances of both legs in the SEBT, the dominant leg showed a significant decrease in the mean normalized reach distance in all 3 directions ( $p = 0.035$ ). The NDT score on their

dominant side was significantly and negatively correlated with the normalized reach distance in the posteromedial and posterolateral directions (Spearman's rank correlation coefficient:  $r_s = -0.385$ ,  $p = 0.012$  and  $r_s = -0.320$ ,  $p = 0.039$ , respectively) and with the mean normalized reach distance in all 3 directions ( $r_s = -0.331$ ,  $p = 0.032$ ). The results showed that excessive foot pronation was a trend toward a decrease in functional dynamic balance such as the SEBT. Therefore, an evaluation of the dominant leg and NDT score may be useful as pre-athletic screening to prevent lower limb injuries in athletic participation.

**Association between stages of change for healthy eating behavior  
and dietary nutritional status among collegiate athletes**

Daigo Takahashi<sup>1</sup>, Kensuke Sakai<sup>2</sup>, Ai Shibata<sup>3</sup>, Kaori Ishii<sup>3</sup>, Kanzo Okazaki<sup>3</sup>, Koichiro Oka<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Pharmaceutical Sciences, Josai International University, <sup>3</sup>Faculty of Sport Sciences, Waseda University

The importance of favorable diet for performance and conditioning of athletes has been well-documented. However, there have been few studies focusing on healthy eating behavior among athletes. Stages of change (SOC) is useful to understand their actual behavior and intention of future behavior. The purpose of the present study is to examine the association between the SOC for healthy eating behavior and dietary nutritional status among collegiate athletes. The cross-sectional survey will be conducted for collegiate athletes aged 18 to 25 years in Waseda university. The participants will be recruited via the Athletic Center of Waseda University from 10 athletic clubs. A questionnaire consists of demographic attributes, the scale of SOC for

healthy eating behavior, and the measures of nutritional intake. Demographic attributes includes age, grade, height, weight, family members, experience years of the sports, and competition achievement. The answer to the scale of the SOC for healthy eating behavior is comprised of five stages (precontemplation, contemplation, preparation, action, maintenance). Food frequency questionnaire, consisting of 28 food items, is utilized to reveal the nutritional intake. The result of nutritional status will be compared to the Dietary Reference Intake for Japanese, 2010. Chi-square test will be used to examine the association between the SOC for healthy eating behavior and dietary nutritional status.

**The difference of lumbar alignment  
between the standing and handstand positions of divers**

Takaya Narita<sup>1</sup>, Koji Kaneoka<sup>2</sup>, Masahiro Takemura<sup>3</sup>, Shumpei Miyakawa<sup>3</sup>, Kouichi Ooyama<sup>4</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University,

<sup>3</sup>Graduate School of Comprehensive Human Sciences Tsukuba University, <sup>4</sup>Tsukuba University Hospital

The purposes of this study were to evaluate the lumbar alignment of divers in the standing and handstand positions. This study included 14 elite junior males divers in Japan. X-ray images of the lumbar alignment were taken at a medical facility, and evaluated using image analyzer software to determine the lumbar lordosis angle, which was formed by the upper edge of the first lumbar vertebra and the lower edge of the fifth lumbar vertebrae. The chi square test was used to examine the relationship between low back pain and lumbar lordosis. The results of the test showed no significant relationship between lumbago and the

lumbar lordosis. The t-test comparing the two groups (decrease and increase lordosis group), revealed a significant difference between the two in the standing position. The greater angle group showed a significantly smaller angle in standing ( $25.2 \pm 3.4^\circ$ ) than those in the smaller angle group ( $33.1 \pm 5.0^\circ$ ). The major findings of this study were 1) male divers with larger lumbar lordosis on standing had decreased lumbar lordosis in the handstand position, and 2) less lumbar lordosis on standing was associated with increased lumbar lordosis in the handstand position.

## **Spatio-temporal perception & bat control in baseball hitting**

Takatoshi Higuchi<sup>1</sup>, Tomoyuki Nagami<sup>1,2</sup>, Nobuaki Mizuguchi<sup>1,2</sup>, Hiroki Nakata<sup>3</sup>, Kazuyuki Kanosue<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Research Fellow of Japan Society for the Promotion of Science, <sup>3</sup>Faculty of Sport Sciences, Waseda University

Baseball hitting is an integrative action of various skills and abilities. Batters must judge when and where a pitched baseball would arrive and strike the ball with a small hitting area of a bat within a split second. This study clarified the relevance of batter's ability in bat control, timing, and spatial perception to the actual hitting accuracy. Nine college baseball batters performed following three tasks. Task 1: hitting a fastball thrown by a pitching machine (30 hits). Task 2: observing the same pitch as the task 1 and indicating the location of the pitch right after the ball passed home plate (20 pitches). Task 3: hitting a ball on a tee with five

different locations (10 hits each). There was significant correlation between the subjects' performance in the actual hitting accuracy and their ability in spatial perception ( $p < 0.05$ ). However, no correlation was found between the actual hitting accuracy and neither timing nor bat control. We concluded that the bat control and timing do not contribute to the difference in the trained batters' actual hitting accuracy. It is suggested that batters with superior ability in the actual hitting accuracy possess greater precision in the spatial perception and ability to make an accurate contact independent of the timing.

**Modification of the maximal voluntary concentric torque after a preceding contraction:  
A comparison between different muscle groups**

Atsuki Fukutani<sup>1</sup>, Naokazu Miyamoto<sup>2</sup>, Hiroaki Kanehisa<sup>3</sup>, Toshimasa Yanai<sup>2</sup>, Yasuo Kawakami<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University,

<sup>3</sup>National Institute of Fitness and Sports in KANOYA

It is known in human that a preceding contraction enhances torque generating capability. It has also been shown that muscle fiber type affects the extent to which torque generating capability is enhanced, and thus, it is expected that the change of the maximal voluntary concentric torque varies between muscles consisting of different muscle fiber types. The purpose of this study was to compare the effect of the preceding contraction on the subsequent maximal voluntary concentric torque between elbow extensors dominated by fast twitch fibers and plantar flexors dominated by slow twitch fibers. Twelve healthy male subjects performed the maximal voluntary isometric elbow extension or plantar flexion for 6

seconds as a preceding contraction. Before and after the preceding contraction, the subjects performed maximal voluntary concentric elbow extensions at 240°/s or plantar flexions at 180°/s. Immediately after the preceding contraction, the maximal voluntary concentric torque during plantar flexion was increased ( $p < 0.05$ ), but not for elbow extension. Unchanged maximal voluntary concentric torque in elbow extensors might be caused by the muscle fatigue induced by the preceding contraction being greater in fast twitch than in slow twitch fibers. It is concluded that the modification of the maximal voluntary concentric torque after the preceding contraction is muscle group-dependent.

## **A study on the lifestyle of sport participants -Focus on triathlon participants-**

Kurumi Matsui<sup>1</sup>, Munehiko Harada<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

This study mainly aimed to examine the lifestyle of sport participants. I focused on two analyses: (1) a review of lifestyle scales and an examination of their adequacy, and (2) a segmentation of sport participants and an examination of the effectiveness. Data were collected from participants at 14 triathlon competitions in 2010. We administered a questionnaire to all participants and collected the data of 1435 of them. First, confirmatory factor analysis was conducted to examine the factor structure of lifestyle on the basis of previous studies. The finding showed that lifestyle scales consist of eight factors (goodness of fit: GFI = 0.93, AGFI = 0.91, CFI = 0.94, RMSEA = 0.05): “mode,” “achievement,” “weak-mindedness,”

“insubstantiality,” “brand,” “sport,” “health control,” and “pro-environmental behavior.” Second, cluster analysis was conducted by using the factor score of these eight factors. The participants were classified into three clusters. The results of the comparison of clusters showed significant differences in the characteristic of these clusters. In conclusion, we found that this lifestyle scales was adequate to measure the lifestyle of sport participants. Moreover, since the cluster analysis result showed significant differences among clusters, segmentation by using lifestyle can be considered an efficient way to understand the sport participants.

**Polymorphisms in the control region of mitochondrial DNA associated with elite Japanese athlete status**

Eri Mikami<sup>1,2</sup>, Noriyuki Fuku<sup>2</sup>, Hideyuki Takahashi<sup>3</sup>, Nao Ohiwa<sup>3</sup>, Yannis P. Pitsiladis<sup>4</sup>, Mitsuru Higuchi<sup>5</sup>,  
Takashi Kawahara<sup>3</sup>, Masashi Tanaka<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Department of Genomics for Longevity and Health, Tokyo Metropolitan Institute of Gerontology, <sup>3</sup>Japan Institute of Sports Sciences, <sup>4</sup>Faculty of Biomedical and Life Sciences (FBLS), University of Glasgow, <sup>5</sup>Faculty of Sport Sciences, Waseda University

The control region of mitochondrial DNA (mtDNA) is about 1.1 kb long in human, containing the origin of replication for the H-strand, the promoters for H- and L-strand transcription, and the binding site of mitochondrial transcription factor A. Certain polymorphisms in this region would, therefore, contribute to elite athletic performance, because mitochondrial function is one of determinants for physical performance. The present study was undertaken to examine the effect of polymorphisms in this region on elite athlete status from whole sequencing of the control region in mtDNA. Subjects comprised 185 elite Japanese athletes who had represented Japan at international competitions (i.e., 100 endurance/middle-power athletes: EMA; 85 sprint/power athletes: SPA) and

672 Japanese controls (CON). The mtDNA control region (m.16024-16569 plus m.1-576 = 1,122-bp) was analyzed by direct sequencing. Frequency differences of polymorphisms (minor allele frequency >5%) in the mtDNA control region between EMA, SPA and CON were examined. EMA displayed excess of three polymorphisms [m.152T>C, long m.514(CA)<sub>n</sub> repeat (n≥5), and extended poly-C stretch (C≥7) at m.568-573] compared with CON. On the other hand, SPA showed greater frequency of the m.204T>C polymorphism compared with CON. These findings suggest that several polymorphisms detected in the control region of mtDNA may influence physical performance due to changes in transcription and replication of mtDNA.

## Physical activity may improve behavioral thermoregulation in mice

Lin Cheng-Hsien<sup>1</sup>, Ken Tokizawa<sup>2</sup>, Kei Nagashima<sup>2,3</sup>

<sup>1</sup>Graduate School of Sport Sciences, <sup>2</sup>Sport Science Center for Active Life, <sup>3</sup>Laboratory of Integrative Physiology (Body Temperature and Fluid Laboratory), Department of Human Sciences, Waseda University

Exercise and physical activity are closely associated with health. In the present study, we tested the hypothesis that physical activity activates behavioral thermoregulation during heat in a dehydrated condition. Mice were divided into two groups: one group had free access to running wheel for 6 weeks (WR, n=6) and the other had no access (NWR, n=10). After s.c. injection (3ml/100g) of either isotonic (154 mM, IS) or hypertonic saline (2,500 mM, HS), each mouse was placed in a behavior box with 5 Peltier boards at the bottom, where a) operant behavior available (the temperature of each board was set at 39°C, one board temperature was changed to 10°C for 60 s when a mice moved to a specific board) or b) thermal gradient (temperature of each board was set at either 15, 22, 28, 35, or 39°C, mice could select preferable position while the temperature setting was changed each 6 min). Compared to the

NWR group with IS, the WR group treated with IS showed similar body core temperature ( $36.8 \pm 0.1^\circ\text{C}$  vs  $37.0 \pm 0.2^\circ\text{C}$ ), smaller operant counts ( $25 \pm 4$  vs  $16 \pm 1$ ), and smaller body weight loss ( $1.4 \pm 0.1$  g vs  $0.6 \pm 0.3$  g) during 90-min exposure to 39°C; in the HS injection study, the NWR group had higher body core temperature ( $38.0 \pm 0.5^\circ\text{C}$  vs  $37.1 \pm 0.5^\circ\text{C}$ ), smaller operant counts ( $11 \pm 5$  vs  $22 \pm 7$ ), and greater body weight loss ( $2.4 \pm 0.4$  g vs  $1.2 \pm 0.2$  g) during 90-min heat exposure (39°C). The data indicate that the WR group maintained their body temperature constant ( $\sim 37^\circ\text{C}$ ) under lower fluid loss and lower heat escape-behavior counts. All the groups of mice showed greater incidence of staying the board set at 35°C in the thermal gradient study. These results may suggest that hyperosmolality suppress thermoregulation in the heat; however, physical activity restores the suppression.

**Sportswomen at modern times China-Through the content analysis  
of the modern times Chinese Newspaper Shen Bao**

Ding Yiyin<sup>1</sup>, Lee Thompson<sup>2</sup>

<sup>1</sup>Graduate school of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

In the contemporary study of sportswomen at Olympics, sport women in diverse continents and countries are generally under-represented. Though sportswomen have received a relatively fair amount of representation during major sports competitions like the Olympics, routine newspaper coverage for women are scarce. ( e.g., Toni Bruce , Jorid Hovden and Pirkko Markula 2010 ) .In sportswomen's coverage, nationality, sexualization, intersectionality, infantilization orientations have been observed. (Pirkko Markula, 2009). In contemporary Chinese sportswomen's coverage sexualization and infantilization attributes have been observed through reports in major Chinese newspapers. In an attempt to interpret this phenomenon the author try to look for possible explanations through the content analysis of the

modern times Chinese Newspaper Shen Bao. Shen Bao was published from April 30, 1872 to May 27, 1949 in Shanghai, China. It played a pivotal role in the formation of public opinion in the late 19th century and was founded as a commercial newspaper. This study will first document the history and the modern times sports development in Shanghai and China. Then the author will analysis the sportswomen reports looking for possible trends and orientations. With connection and comparison to the contemporary reports of sportsmen and sportswomen's reports nowadays. The author will try to document the women sports' development and the explanations for the current situation and position of Chinese sportswomen and women's sports.

## Proximal and distal factors and step width on knee joint kinematics during running

Masanori Sakaguchi<sup>1</sup>, Norifumi Shimizu<sup>1</sup>, Toshimasa Yanai<sup>2</sup>, Yasuo Kawakami<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The purposes of this study were to describe the interrelations among ankle, knee and hip joint kinematics, and to clarify the influence of the variability of step width on knee joint kinematics during running. Seventy runners (54 males and 16 females) participated in this study. Subjects ran along a 25m runway at a speed of 4 m/s. Three-dimensional marker positions were recorded with a motion analysis system. The peak knee abduction angle correlated positively with the peak hip adduction angle ( $r = 0.411$ ,  $p < 0.001$ ) and negatively with the peak rearfoot eversion angle ( $r = -0.724$ ,  $p < 0.001$ ). The stepwise multiple

regression analysis revealed that the peak knee abduction angle could be predicted by the peak rearfoot eversion angle and the peak hip adduction angle (adjusted  $r^2 = 0.574$ ). Furthermore, the step width was negatively correlated with the peak rearfoot eversion angle ( $r = -0.409$ ,  $p < 0.001$ ), but not with knee and hip joint kinematics. These results indicate that the rearfoot and hip kinematics are likely to be the distal and proximal factors on knee joint kinematics, respectively. The step width may influence knee joint kinematics indirectly, by affecting rearfoot kinematics.

**Application of model-based image-matching to the sport performance analysis:  
the case report of a comparison between real game situation and training situation**

Shogo Sasaki<sup>1</sup>, Toru Fukubayashi<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The purpose of this study was to determine the reliability of model-based image-matching (MBIM) technique while analyzing sport specific movement and compare training situation to real game situation using this technique. First, we investigated intra- and inter-rater reliability of MBIM in real soccer game situation. Ratings were used intraclass correlation coefficient (ICC). Overall intra- and inter-rater agreements ranged from good to excellent ( $ICC > 0.83$ ), combined with pelvic movement in horizontal plane. These results suggest that it is very important to match pelvis with great precision using MBIM. Secondly, we conducted three-dimensional motion reconstruction from two video sequences, one is a training situation and another is a real game

situation, by MBIM technique. Each scene is a defensive situation responding to dribble attacking in the vital area. Changes of direction scenes of defensive soccer player were analyzed. Trunk, hip, knee kinematics and peak ground reaction force for two cases were measured. Trunk forward angular displacement in real game situation is larger than that in training situation. Peak vertical ground reaction force occurred at the timing of trunk forward inclination angle of approximately  $40^\circ$  and trunk lateral inclination angle of approximately  $10^\circ$ . These findings suggested that stability and optimal angles of the trunk is an important factor for the change of direction performance during defensive soccer situations.

## The individual difference in fastball flight trajectory and ball spin in baseball pitching

Tomoyuki Nagami<sup>1,2</sup>, Takatoshi Higuchi<sup>1</sup>, Toshimasa Yanai<sup>3</sup>, Kazuyuki Kanosue<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Research Fellow of the Japan Society for the Promotion of Science, <sup>3</sup>Faculty of Sport Sciences, Waseda University

In this study, we investigated the cause of individual difference in the vertical displacement of a fastball in baseball pitching based on ball flight trajectory, its spin rate, and the direction of spin axis. Seven right-handed collegiate pitchers threw three four-seam fastballs from an official pitching mound to a catcher. The flight of the ball and the spin of the ball were recorded using four high-speed video cameras. The three-dimensional coordinates of the trajectory of the ball were obtained with DLT procedures, and the orientation

of ball spin axis was obtained using a custom-made apparatus. The difference between the arrival height of an actual trajectory and its predicted trajectory ( $\Delta Z$ ) was closely correlated with the vertical component of spin parameter ( $Sp_{ver}$ ). In order to add more “hop” to the fastball, either increasing spin rate or adjusting spin angle is effective. However, which factor should be focused depends on the physical characteristics of pitched ball of individual pitchers.

## **Menstrual cycle and carbohydrate ingestion affect the increase in leucocytes during prolonged exercise in hot environment**

Hideki Hashimoto<sup>1</sup>, Toshimichi Ishijima<sup>2</sup>, Katsuhiko Suzuki<sup>3</sup>, Mitsuru Higuchi<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Waseda Sport Science Research Center, Waseda University, <sup>3</sup>Faculty of Sport Sciences, Waseda University

This study examined the effect of the menstrual cycle and carbohydrate ingestion on physiological and immunological responses during prolonged exercise in a hot environment. Six healthy women with regular menstrual cycles completed two trials comprising 90 min of cycling exercise at intensity of 50%  $\dot{V}O_2$  peak and performance test in a hot environment (temperature, 30°C; humidity, 50%) at the follicular phase (FP; days 5-9) and luteal phase (LP; days 20-24) of their menstrual cycle, respectively. Four trials were composed following: two trials under the carbohydrate drink ingestion (CH) in the FP and LP (F-C and L-C) and two under the 0 calorie drink (sweetened by artificial

sweetener) ingestion (AT) in the FP and LP (F-A and L-A). During 90 min exercise, the respiratory exchange ratio was lower in the FP than in the LP in both CH and AT trials. Although the number of leucocytes increased at the end of 90 min exercise and after the performance test in all trials, the increase in leukocytes was suppressed by carbohydrate drink ingestion. Furthermore, the increase in leucocytes was higher in L-A than in F-A. These results suggested that the higher increase in leucocytes during prolonged exercise in L-A than in F-A might be responsible for the difference in endogenous carbohydrate oxidation between luteal phase and follicular phase.

**Attempt for evaluation of muscle activation properties during running  
using the time-frequency analysis**

Ayako Higashihara<sup>1</sup>, Toru Fukubayashi<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

Time-frequency analysis of electromyography (EMG) has been widely used to evaluate the EMG signal property. Recent several studies have shown that the continuous wavelet transform (CWT) method is more appropriate for analysis of the EMG signal during dynamic contractions than other time-frequency methods. The purpose of this study was to evaluate hamstring muscle activation at different running speeds using the CWT method. Surface EMG was recorded from biceps femoris muscle and semitendinosus muscle in healthy male track and field athletes during treadmill running at 50% and 95% of their maximum velocity. For each

running speeds, the EMG signal of one stride were analyzed. All data processing was conducted offline using LabVIEW2009 with the Advanced Signal Processing toolbox (National Instruments, Austin, TX). In this poster presentation, we introduce an individual example of the CWT methods to analyze the EMG signals during running at different speeds by evaluating the time-dependent spectral moments. In addition, changes in motor unit recruitment at different running speeds according to the instantaneous mean frequency (IMNF) based on the CWT method were also exemplified and discussed.

## Characteristics of classic style technique during starting phase in cross-country skiing

Zenya Fujita<sup>1</sup>, Ryuta Kinugasa<sup>2,3</sup>, Kenji Tauchi<sup>2</sup>, Jun Tsuchiya<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University,

<sup>3</sup>RIKEN

The purpose of this study was to clarify characteristics of double-poling (DP), diagonal stride (DIAG) techniques, and those combinations (COMB) during starting phase of cross-country-skiing. Five male cross-country skiers including the Japan national team performed sets of maximal effort of each three technique on flat and straight snow track. The motion was captured with the laser distance meter (Laveg-sports, Jenoptik) and high-speed camera (EX-F1, Casio). The time, mean and maximum velocities, number of cycle, cycle length and cycle rate were analyzed. Our result revealed the following: (1) required time of 50 m were not

changed significantly among techniques. (2) maximum velocity was significantly higher in the DP than the DIAG. (3) although mean velocity was significantly higher in the DIAG during 10-20 m phase than the DP, the trend was changed during 30-50 m phase (DP > DIAG). (4) for the COMB trial, all subjects used the DIAG first, followed by the DP. Those results suggested that cross-country skier used the DIAG for acceleration, switched to the DP in order to achieving the maximum velocity, indicating interchange technique may play an important role for jump start from the early phase of competition.

## Force dependent modulation of corticospinal excitability during motor imagery

Nobuaki Mizuguchi<sup>1,2</sup>, Masanori Sakamoto<sup>3</sup>, Hiroki Nakata<sup>3</sup>, Kazuyuki Kanosue<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Research fellow of the Japan Society for the Promotion of Science, <sup>3</sup>Faculty of Sport Sciences, Waseda University

Motor imagery is defined as the mental execution of a movement without any muscle activity. We investigated whether corticospinal excitability during imagery of index finger abduction was affected by the level of imagined force. Corticospinal excitability was assessed by motor evoked potentials (MEPs). Electromyography (EMG) activity was recorded from the right first dorsal interosseous muscle (FDI). Before the trials, subject's EMG activity was recorded during the maximum voluntary contraction (MVC) of index finger abduction. Subjects practiced to perform the calculated 50% and 10% MVC. After the practice, the MEPs were recorded during the imagery of 10%, 50% and

100% MVC. After MEPs recording, we assigned subjects to reproduce the actual index finger abduction at the 10% and 50%. The averages of EMG activity of force reproduction task were  $21.2 \pm 4.0\%$  in the 10% MVC condition and  $57.5 \pm 7.2\%$  MVC in the 50% MVC condition. The MEPs amplitudes in the 100% and 50% MVC condition were significantly greater than those in the 10% MVC condition ( $p < 0.05$ ). Previous study showed that all motor units in FDI were recruited about 50% MVC (De Luca et al. 1982). We considered that enhancement of corticospinal excitability during the imagery of force production reflects by the number of motor units recruited for the actual force production.

## The role of sensory feedback in sensory-motor learning

Rintaro Ogane<sup>1</sup>, Masaaki Honda<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The purpose of this study is to investigate the role of sensory feedback (visual feedback, somatosensory feedback, auditory feedback) in sensory-motor learning. In this study, we focus on auditory feedback in speech articulatory movements, and we examined the relationship between the auditory feedback and the speech dynamics. TD-PSOLA (Time-Domain Pitch Synchronous Overlap and Add) method was used for the real-time time-scale modification. The temporal perturbation was applied at the transition interval of semi-vowel /ya/. Experiments are

conducted to study effects on the temporal speech compensation for the time-scale modification scales (1.0, 1.2, 1.4, 1.6, 1.8) in 3 sections (control, perturbation, return). Speech compensation was examined in term of the time difference between onset timings of two formant frequencies (F1 and F2). As the result, the F2 onset timing is faster than F1 onset timing in perturbation section compared with control section. These results suggest that the tongue movement timing is faster than jaw opening timing.

## **Electromyography analysis of scapular muscles in baseball pitching Comparison fastball and curveball**

Motozumi Kitsunai<sup>1</sup>, Fuminari Kaneko<sup>2</sup>, Toshihiko Hashimoto<sup>3</sup>, Toru Fukubayashi<sup>4</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Sapporo Medical University, <sup>3</sup>Ryotokuji University,  
<sup>4</sup>Faculty of Sport Sciences, Waseda University

The purpose of our investigation was to compare dynamically EMG activity of scapular muscles between fastball and curveball in baseball pitching. 9 male subjects without a history of shoulder pain or pathology joined. After stretching and warming up, the subjects threw five fastball and curve ball pitches overhand. Pitching phase was determined with High-speed digital camera and we intended for five pitching phase. EMG recording was recorded 8 muscles: rhomboid major (RMJ) and minor (RMN), supraspinatus (SSP), infraspinatus (ISP), upper /middle / lower trapezius (UT/ MT/LT) and serratus anterior muscles (SA) . In both pitches, the RMN activity demonstrated high activity during deceleration phase and it was significantly different

to late cocking phase ( $P<0.05$ ). Especially, in late cocking phase, RMN activity for the fastball was significantly higher than for the curveball. In addition, there was low scapular muscle's activity but shoulder muscle activity was high in curveball pitch. ISP activity for the curveball was higher than fastball. In general, the shoulder moment was less when throwing a curveball than when throwing a fastball. In this study, there were few significant electromyographic change between the fastball and curveball but it is possibility that scapular kinematics was different and the rising incidence of shoulder injuries in pitchers may be caused by curveball pitch.

## **Efficacy of the injury prevention program on football -Knee and trunk kinematics during anticipated and unanticipated side-step cutting-**

Yasuaki Saho<sup>1</sup>, Tomomi Suzuki<sup>1</sup>, Takuma Hoshiba<sup>1</sup>, Toru Fukubayashi<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The aim of this study was to investigate whether the injury prevention program would reduce the risk of knee ligament injury. Ten collegiate football players trained the injury prevention program, “The11”, for 6 months. Prior and after intervention, subjects performed 3 maneuvers; a straight run, a sidestep cutting, and a crossover cutting, under two different conditions; anticipated and unanticipated. Using a target board with three LED, subjects were given cues for 1 of the 3 tasks in both the anticipated and unanticipated conditions. Subjects received the cue before the trial, for the anticipated trials. During unanticipated trials, subjects received visual cue approximately 500 msec before reaching

step position. Three dimensional motion analysis system was used to measure knee and trunk motion during tasks. For this study, only the side-step cutting was analyzed. During anticipated task, the peak value of knee abduction angle after training was lower than before training ( $p<0.05$ ). During unanticipated task, tibial internal rotation angle after training was lower than before training ( $p<0.05$ ). Trunk orientation angles were not significant difference between before and after training ( $p<0.05$ ). The results of this study indicated that The11 program has potential to change the knee motion to avoid the severe knee injuries.

## **Impact of introduction of Compulsory Competitive Tendering on the number of users of public sports facilities**

Hiroto Shoji<sup>1</sup>, Yoshiyuki Mano<sup>2</sup>, Yoshio Nakamura<sup>2</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>Faculty of Sport Sciences, Waseda University

The Local Authority act of Japan was revised in September 2003 in order to reduce the costs and improve the quality of public services. As a result of the Act, all local authorities had to introduce CCT for public sports facilities by September 2006. The purpose of the present study was to examine whether the introduction of Compulsory Competitive Tendering (CCT) influences number of users of sports facilities. The pre-CCT data were collected in March 2005 and the post-CCT data were collected in September 2007. In total, 283 respondents in both 2005 and 2007 were asked to complete the questionnaire. In no CCT-introduced

sports facilities, the number of individual users, user groups, teaching course users were no significant difference between 2005 and 2007. Whereas, in CCT-introduced sports facilities, the number of user groups and teaching course users increased significantly between pre-CCT (2005) and post-CCT (2007) ( $p < 0.005$ ). These results indicate that the introduction of CCT into sports facilities increases the number of user groups and teaching course users. It was possible that the introduction of CCT into sports facilities improved the usability of user groups and the level of teaching course.

**Physical activity level of Japanese female collegiate athletes  
during the period of training**

Motoko Taguchi<sup>1</sup>, Kazuko Ishikawa-Takata<sup>2</sup>, Mitsuru Higuchi<sup>3</sup>

<sup>1</sup>Graduate School of Sport Sciences, Waseda University, <sup>2</sup>National Institute of Health and Nutrition,

<sup>3</sup>Faculty of Sport Sciences, Waseda University

Energy requirement can be calculated using the estimation equation based on resting energy expenditure (REE) and physical activity level (PAL). However, currently there are only few studies measuring PAL of Japanese female athletes. Therefore, the purpose of this study was to obtain the PAL of Japanese female athletes in different types of sports during their period of training. Forty-four athletes who belong to middle- and long-distance running (n=8), swimming (n=12), rhythmic gymnastics (n=10), and lacrosse (n=14) (age  $20.3 \pm 0.9$ y, height  $161.3 \pm 5.1$ cm, body weight  $54.3 \pm 6.3$ kg, percentage of body fat  $20.7 \pm 3.6$ %,

fat-free mass  $42.9 \pm 3.8$ kg) were participated in this study. Total energy expenditure (TEE) was measured using a doubly labeled water technique in conjunction with REE measured by indirect calorimetry. PAL for each sport was calculated by dividing TEE by REE, which were  $2.3 \pm 0.3$ ,  $2.6 \pm 0.4$ ,  $2.5 \pm 0.5$ ,  $2.4 \pm 0.5$ , respectively. Our data was dissimilar to those proposed by the Japan Institute of Sports Sciences. The PAL for above mentioned sports were decided from this study, however, collecting further PAL data as well as its training statuses are needed to help accurately estimate energy requirements of Japanese female athletes.