

The 6th International Sport Science Symposium on “Active Life”  
【Poster Presentation / Abstract】

Sport Sciences, 9, 106-198, 2012  
Accepted for publication: 28 April 2012

**[1. Sport Philosophy]**

**[1-1]**

**A study on right or wrong of pitcher retaliation in baseball**

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In baseball, the pitcher intentionally pitches at the batter for the violation of implicit conventions. Such behaviors are prohibited by the rule 8.02(d) in “Official Baseball Rules”. Those who violate this rule are expelled or warned by the umpire. In 2006, the California Supreme Court, however, permitted the convention which the pitcher intentionally throws a ball at the batter. Though a study on right or wrong of pitcher retaliation in baseball has been discussed by the scholars, the conclusion has not been attached in the area of sport philosophy.

The purpose of this study was to clarify the point to be solved through reviewing previous studies on right or wrong of pitcher retaliation in

baseball.

In this study, the method was to evaluate previous studies on “Journal of the philosophy of sport” published by the International Association for the Philosophy of Sport.

The points to be solved are as follows.

1. Players permit preventive self-defense in baseball or not.
2. The intentional pitch for the batter is regarded as a distinctive excellence in baseball or not.

To analyze the methodology of applied ethics is the issue in the future, which attempts to solve the ethical problems in modern society.

## [2. Sport History]

### [2-1]

#### **Research on Chinese universities' sport from the Late Qing Dynasty to the Republic of China**

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This paper discusses Chinese university's sport with historical perspective from the late Qing Dynasty to the Republic of China. During the periods, there are mainly three types of universities, Christian university, national university and private university. Sports first appeared in Christian universities. Students gradually accepted sports. When introduced into Christian universities, sports did not encounter strong cultural resistance between Chinese and Western. Physical education were established as curriculum in 1898 at Imperial University of Peking, however, sport was not popular at national universities and private universities until 1920s, only little universities have sport as extra-curricular activities. From 1910s to 1930s, sport was popular at some universities such as ST. John's and Soochow as Christian universities, Tsinghua as national university and Nankai as

private university, sport organizations were built among universities, such as "Big Five" in Beijing and "Big Eight" in East China. Universities' sport represented top level in China. Most of Chinese athletes who came from universities took part in the world competition games such as the Far Eastern Championship Games and the Olympics Games. Because of wars, university sport rapidly declined from 1937 to 1949.

The paper's conclusions are that: a) universities, especially Christian universities, were one of ways which introduced sports into China. b) universities' sport represented top level from 1910s to 1930s in China. Athletes who trained at universities were the main force in kinds of Games. c) universities' sport led the development of Chinese attitude toward the body.

### [3. Sport Anthropology]

#### [3-1]

### Investigate the significance of spreading traditional sports culture through the sport Sumo

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Although this subject has been studied by Chinese scholars as well as Japanese scholars, in China, there is a decline in study about the origin of Sumo. There are fewer materials about Sumo which could be got in China. I could get more historical materials, and do some information collection in Japan. In this way, I could do a thorough comparison of the origin of Sumo.

Sumo since its birth in ancient China Development has gone through many changes of dynasties, throughout the development process

of Chinese ancient history.

The current is the time of ancient Chinese sumo sort.

Plan to read through a lot of literature and information, to further clarify the origin of sumo movement and development in China. Then, research to the Japanese sumo. Finally, the conclusions of the study, found that China and Japan two countries learn from each other's experiences, promotes the traditional sports culture dissemination together.

[3-2]

**Belly dance movements for psychotherapy - developing history and applications**

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Belly dance is claimed by dancers and researchers to be an empowering path for women to become more aware of their bodies, experience sexual subjectivity, creatively express their inner feelings and emotions, and form new friendships. These days, the application of belly dance is becoming wider. In particular, the dance has been included into medical system as an alternative psychotherapy. This study firstly aims to explore how the linkage among belly dance, women's confidence and healing was made. The second aim is to analyze how belly dance is appropriated and applied in the western medicine system. Methodology of literary analysis was adopted.

This study achieved two results: (1) During the women's liberation movement of the 1960s and 1970s, belly dance was taken by American feminists as a more liberated approach toward physical expression, sexual desires and femininity exploration. Since then, belly dance is more frequently to be claimed with healing power for women. (2) Some licensed dance/movement therapists who know belly dance have brought the movements into their work with their clients, and it is claimed to be helpful for those suffering from the emotional hardship faced after experiencing breast cancer surgery, bulimia, rape or sexual abuse.

[3-3]

**The acceptance of Japanese Bushidou Yakyuu in Taiwan**

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Japanese introduced baseball to Taiwanese when Taiwan became their first colony. Japanese were the foundation of Taiwanese baseball before 1920, few Taiwanese involved in baseball and related organizations. This phenomenon started changing when Taiwanese enthusiastically accepted primary education. Taiwanese got to understand Samurai spirit of game through the gymnastics courses of public schools. Because of school education, much and more Taiwanese people took part in baseball after 1920.

Kano baseball team founded in 1928, the team

members included Japanese, Han Chinese and Taiwan indigenous people. The coach Kondo Heitaro guided the team based on concepts of 'spirit yakyuu' and 'equalitarianism'. Kano represented Taiwan to join All Japan Middle School Baseball Tournament in 1931 and won the second prize. Japanese media reported that Kano players performed the body technique, manners and spirits of Japanese baseball. We can say, Taiwanese embodied Japanese spirits through the acceptance and practice of Bushidou yakyuu.

## [4. Sport Sociology]

### [4-1]

#### **National identity and sporting stereotypes in Chinese press coverage of Chinese versus foreign athletes**

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“Nation” carries the meaning of being born and by extension a group united by common origins. Diverse discussions have explored geographical, linguistic, biological, traditional and cultural aspects of the definition of “origins.”

Based on past research orientations this research proposes the following hypotheses: Modern sports discursive networks-especially coverage of foreign and Chinese athletes express interpretations of the relative economic and political status of modern China in the world and her relations with other countries and regions.

To test the above hypothesis, this research intends to conduct a content analysis of news reports concerning Chinese and foreign athletes carried by major printed sources in China including: Titan Sport and the People’s Daily. Titan Sport is the best selling privately owned

sports newspaper and the People’s Daily is one of the Chinese Communist Party’s (CCP) leading mouthpieces.

This research intends to search for related sport articles and/or headlines containing the word “强/强大” (pingyin: qiang da, meaning strong, powerful, energetic in Chinese) in these printed sources. “Qiang da” is one of the most frequently used expressions in Chinese and always meant to show power and dominance. It is commonly used when comparing two opponents. Through my observation of sports coverage concerning Chinese and foreign athletes this term appears to be used more often in relation to foreign athletes. This research will also analysis other possible variables and discusses possible orientations in these selected news coverage.

[4-2]

**The Relationship of Living and Exercise Capabilities and Physical Self-Concept, Subjective Happiness on the Aged Persistent Participants in use of Outdoor Sport Equipment**

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The purpose of this study is to identify the relationship of Exercise Capacities, Physical Self-Concept, Subjective Happiness on the Aged Persistent Participants in use of Outdoor Sport Equipment. For accomplishing this purpose of the study, the survey questionnaires (286/308 except 22) were used to collect data. To process the data for this study, SPSS Version 18.0 was used for the frequency analysis on demographical characteristics, exploratory factor analysis, reliability and relationships, After the exploratory factor analysis, AMOS Version 7.0 was used for the confirmatory factor analysis and SEM(Structural Equation Modeling) on hypothesis for this study. The result of this study are shown as below;

At first, it could be confirmed that exercise capabilities which were the independent variables had a significant effect on sport-confidence and physical condition of physical self-concept, which was the mediating variables. The second, it could be confirmed that sport confidence and attractive body had a significant effect on subjective happiness, which was the dependent variables. The third, it could be confirmed that Living capabilities had a significant effect on subjective happiness, which was the dependent variables.

This research project was supported by the Sports Promotion Fund of Seoul Olympic Sports Promotion Foundation from Ministry of Culture, Sports and Tourism (KRF/2010/8/1105)

[4-3]

**Senior satisfaction and commitment levels regarding the use of outdoor exercise equipment**

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This research project recorded and analyzed statistics regarding seniors using the various outdoor exercise equipment facilities being constructed in public parks around Seoul. Through this analysis it uncovered the differences between senior satisfaction and commitment levels regarding equipment use, as well as the factors that influence these levels. As a result, this project was able to collect data crucial for the creative development of outdoor exercise equipment. This project's data was collected in various public parks throughout Seoul from 246 male and female seniors. All data collected was processed with SPSS Version 18.0 for Windows, and analyzed using reliability analysis, factor analysis, frequency analysis, independent sample t-test and one-way ANOVA. All variable analysis, including the post-analysis

This research project was supported by the Sports Promotion Fund of Seoul Olympic Sports

were carried out using Scheffe's method, and all data regarding the satisfaction and commitment levels in regards to the facilities were initially analyzed using a correlation analysis, with after-tests being conducted using multiple regression analysis.

The final results of this project are as follows: first, there are differences in the satisfaction levels regarding outdoor exercise equipment facilities depending on the characteristics of the senior population. Second, there are also differences in the commitment levels regarding outdoor exercise equipment facilities depending on the characteristics of the senior population. Lastly, the satisfaction levels of using a particular outdoor exercise equipment facility have a direct influence on the commitment levels of the seniors who use said facilities.

Promotion Foundation from Ministry of Culture, Sports and Tourism (KRF/2010/8/1105)



[4-4]

**Research on sport -related values and Chinese athletes**

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The purpose of this study is to examine and collect data on the sport-related values of Chinese elite athletes. SPSS Windows 17.0 version was used for processing the data of the research. The results of this study are as follows: Male athletes revealed more economic and social relation value than the female athletes. Participating in individually sporting athletes showed more the view of aesthetic value than those in team sports. In academic career athletes over undergraduate

university showed more politic and social relation value than those in high school student or high school graduated.

In the view of sports value according as the national athlete career year, more than 5 year showed more the view of social relation and economic value than less than 5 year. In addition those attained the honor in Olympic Games or Asian Games showed more of the view of economic and aesthetic value.

[4-5]

**The governance of body: Colonialism and Sports in Taiwan from 1895 to 1945**

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This study intends to discover the embodied ideological and bodily concepts of the Japanese colonizers, especially within the realm of sports and physical education curriculum during the occupancy era. This historical inspection is examined with the context of political, cultural and economic background, which entails the process of modernization and civilization of colony.

Pervious researches indicate that the purposes of promoting sports and physical education in colony aim to improve, train, and regulate the body of Taiwanese students. This regulation not only enforce upon the tangible physical body,

but also the norms of minds. For example, through the learning of Gymnastics, the new body image of Taiwanese was thus constructed, the colonized then fits in the desirable characteristics of Japanese, the character that emphasis coordination, obeying rules, and self-restrained.

I thus concluded that under the disguise of proclaimed civilizing, the sport and physical education appeared in the face of cultural assimilation, which potentially contained the discriminating and controlling policies against the colonized.

[4-6]

**The power performance of dancesport**

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The dance clubs in Taiwan are very common, from parks, communities, schools to dance studios, from children, teenagers to elders. There are over 1 million people like this activity (T.D.D.A, 2010).

Nowadays, in Taiwan, there are three ways in dancesport type: “dancing club”, “professional dancer training” and “internal competition and super star show”.

In order to improve dancers’ technique, in 1994, Chinese Taipei DanceSport Federation was founded, it’s provide dancers and coaches to prepare for international competitions. Unfortunately, Taiwan never got world championship on international stage.

The purpose of this study are to discuss how the dancesport influenced by power whining the

development process? And how the body influenced by power in dancesport? Semi structured interview and literature collection was be used in this study.

This study find when dancers start to dance, they could not dance free, and should follow the normalization of dresses, pose, music, temple, etc., because of the rules in the dancesport. Outline of an historical view of the development of dancesport in Taiwan, it was controlled by state apparatus. At first, dancesport was an underground activity, after the allowing of organic law, dancesport gradually gained popular. The competition is affected by power struggle, the results relative to the relationship with judgments.

## [5. Sport Management]

### [5-1]

#### **Customer delight in sports: A replication and an examination of moderator effects in the customer delight and satisfaction model**

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“Sport delights people” is a widely used phrase. This study aims to examine causal relations with regard to customer delight and customer satisfaction. Further, it explores the effect of customer delight and satisfaction on spectators’ intentions of attending future games and encouraging others to watch sports at the stadium through positive word-of-mouth. The study considers the effect of the result of the game, gender of spectators, frequency of past attendance, and involvement and knowledge of the sport team as moderating variables and conducts structural equation modeling and simultaneous multi-sample analysis.

The following results were found: (1) Although positive affect strongly influenced customer delight as an antecedent factor, owing

to the sequence—surprise consumption/disconfirmation → arousal → positive affect—surprise consumption/positive disconfirmation was also needed to arouse customer delight. (2) Sport teams need to establish mutually complementary relationships, considering that they can arouse customer delight during every game and cause cumulative satisfaction. (3) The influence of customer delight and customer satisfaction was different depending on the result of the game, indicating the importance of fulfilling customer satisfaction despite losing a game. (4) Increasing the involvement and knowledge level of the favorite sport team could be one way of arousing customer delight.

[5-2]

**A conceptual framework for understanding the motives  
of sport spectator in China**

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The purpose of the study was to expand the current sport spectators' motives literature by developing a conceptual model for evaluating motives of sport spectators in China. Whereas conventional researches on sport spectators' motives have been mainly focused on spectators in the United States or in European countries, there has been scant research on Chinese sport spectators. This study, based on a literature review of sport spectators' motives in different countries, among different sports, and sports of different levels, was trying to develop a special model for evaluating motives of sport spectators in China. Meanwhile, in light of some statistics

data of demographic factors of Chinese sport spectators from previous studies and the literature from related fields such as sport consumer behavior and sports marketing, we were trying to define causes and effects of sport spectators' motives, thus gave some useful suggestions for sport managers and sport marketers. Finally, this paper also provided suggestions for future research that emphasizes on the generalization and globalization of research on sport spectators' motives, such as a standardized or a basic scale for evaluating the motives of sport spectators and taking culture differences into account.

[5-3]

**Is the demonstration program the legacy of the National Sports Festival?**

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The demonstration program, one of the sport events of the National Sports Festival, has been held by the municipality of the hosting prefecture every year for the residents. In this program, there have been many kinds of new sports events such as Ground Golf, Indiaca, etc. We focused on these programs and to reveal the existence of sport legacies of the National Sports Festival and to clarify the types of these legacies. In order to do so, we investigated the changes that have taken place before and after in the activities of the new sports in almost all the demonstration programs which had been held during 1996 and 2005. As a result, it became clear that sport legacies continue to exist in the hosting municipalities (22.1%), and those legacies can be classified generally into the following 4 types.

- a) Municipalities where the new sports' activities arose by holding the demonstration programs.
- b) Municipalities where the new sports' activities arose by holding the demonstration programs and new associations or groups of the new sports had been organized after holding the demonstration program.
- c) Municipalities where activities related to the new sports already existed, and after holding the demonstration program, some associations or groups of the new sports had been integrated or readjusted.
- d) Municipalities which started to hold new sports events, after holding the demonstration program.

[5-4]

**A lifestyle study of “new endurance sports” participants – Focus on triathletes**

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This study aims to verify the relationship between participation in “new endurance sports” (NES) and the participants’ pro-environmental behavior, which is a lifestyle factor. This study employed the results of Matsui et al. (2010) and conducted a stepwise regression analysis on data for three clusters of NES participants. As independent variables, the analysis included participants’ age, the number of years participating in triathlons, participants’ age when they participated in their first triathlon, and the number of triathlons in which they had competed. The factor score for pro-environmental behavior was the dependent variable. The results showed that age ( $\beta = 0.16$ ,  $R^2 = 0.02$ ) was the presiding factor for the first cluster and that the number of

years participating in triathlons was most significant for the second and third clusters ( $\beta = 0.17$ ,  $R^2 = 0.03$ ;  $\beta = 0.13$ ,  $R^2 = 0.02$ ). Among participants who had spent fewer years as triathletes, age was the most significant determinant of pro-environmental behavior. Among participants with more experience as triathletes, the number of years participating in triathlons was the most significant factor. The results clearly indicate a relationship between NES experience and pro-environmental behavior. However, the coefficients of determination were small. Future study is needed to verify this relationship using other variables related to NES participation.

[5-5]

**The relationship of sports and leisure organizations in Taiwan**

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The purposes of the study were to understand the relationship of sports and leisure organizations in Taiwan. The methods employed by this study were content analysis and in-depth interviews. Eleven leaders from local governments and NPOs were chosen as the interviewees of the study. Firstly, the results showed that 1987 and 1999 are two watersheds in the historical process of developing NPOs in Taiwan. Next, the results showed that NPOs developed a complementary relationship with government. NPOs complemented basic government service, and government played a partner role with NPOs. Meanwhile, with limited funds from government and members, similar NPOs must compete against each other. This

result caused that different NPOs cooperated with each other.

Finally, the results indicated that government usually provides grant to NPOs to conduct activities and build facilities. Since all budget spent on pensions and social welfare for the elderly, government usually have limited funds for NPOs. The financial status of NPOs remained unstable. To conclude, owing to a shortage of professionals and youth, the organizations faced problems mostly with regard to financial support and the execution of programs. Furthermore, the government and NPOs developed the complementary organizational relationship and exchanged resources; however, they usually lacked of communication in between.



## [6. Human Growth and Development]

### [6-1]

#### Correlates of school-based physical activity among Japanese junior high students

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**Objective:** This cross-sectional study examined the direct and indirect effects of perceived school physical environment, social support, self-efficacy and BMI on school-based physical activity among Japanese junior high school students.

**Methods:** 608 students (boy n=312, girl n=296) who belonged to a public junior high school, in Okayama city, Japan, completed the self-reported measures of school-based physical activity (after school hours physical activity at school), BMI, self-efficacy, two sources of social support (teacher and friend) and three factors of school physical environment (equipment, facility, and safety). Structural equation modeling controlling for age was performed to examine the effects of self-efficacy, social support, physical environmental variables and BMI on

physical activity among boys and girls, respectively.

**Results:** The structural model demonstrated an acceptable fit. For boys, self-efficacy, teacher support and BMI exhibited a direct effect on the after school physical activity. Perceived equipment, facility, and safety and friend support exhibited an indirect effect on physical activity which was mediated by self-efficacy. Among girls, perceived friend support exhibited direct effect on physical activity while others exhibit neither direct nor indirect effects on self-reported physical activity.

**Conclusion:** Findings indicates that effective interventions may differ according to the different physical activity behavioral model among boys and girls.

**[7. Pedagogy of Physical Education]**

**[7-1]**

**A study on the theory about curriculum in Physical Education by Toshio Nakamura  
-With focus on the formative process of “Nakamura Plan”-**

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In the Pedagogy of Physical Education, it was required to construct the learning theory that is making point of “to understand” (Takahashi, 2011). In this situation, the theory of Physical Education by Toshio Nakamura was the pioneering. His theory, however, had not been reviewed so far, because of the historical ethos that “to understand” was not important in Physical Education (Tomozoe, 1999).

This paper explored the subject of his theory about curriculum in Physical Education which is called “Nakamura Plan” (Izuhara, 2007) with

focus on the formative process of it.

In conclusion, his theory had three inner subjects which were about “the organization of the contents”, “the way to teach” and “the theoretical background”. It had also two outer subjects in terms of “the overcoming the physical domain” and “the formation of public educational society”. Moreover, the cause of his theoretical subjects was that he had an alternative thought made through his formative process of “Nakamura Plan”.

[7-2]

**A Research into the teaching program on the acquirement of no breath crawl for 3rd and 4th grade in the elementary school**

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This study aims to examine how effective the national curriculum of elementary school for the 3rd and 4th grade is. In this context, floating and swimming are especially required to be accomplished in water. The reason is that the purpose of skill in the 5th and 6th grade is to crawl, to swim continuously over a long-distance, thus we need a preliminary step.

As a result, from June to September in 2011, we had carried out a swimming test which applied the program of teaching program for the acquirement of no breath crawl. It was intended for 8 students (out of 31 students) with the

ability of floating, but not swimming. In order to make sure their accomplishment from the subjective point of view, they evaluated it by themselves. Moreover, we had implemented the measurement of no breath crawl, before and after the program, to check how much they could acquire the skill. In fact, the significant difference could be seen and the assessment through this teaching program was getting higher, compared to the early stage. Therefore, this research was able to show the effectiveness of the acquirement for no breath crawl.

[7-3]

**A study on teaching material of dance in Physical Education:  
With focus on the effort by Gakkou Taiiku Kenkyu Doshikai**

Sho Nakamori

Graduate School of Sports Sciences, Waseda University

This study aimed to demonstrate what the private educational and research organization in Japan has worked on a teaching material which specialized in dance. Especially, it focused on the commitment of “Doushikai”. The reason is that the study of dance education has not caught up on the theoretical domain, even though the 1st and 2nd grade at the junior high school will need to learn the dance domain from 2012 with the revision of a course of study. Therefore, there might be necessary to be investigated more than before.

As a result, 3 points could be found from the researches on the teaching material of dance by

“Doushikai”. One is that we were able to have positioned the Japanese folk dance as the replacement of the teaching material. Secondly, the structure of technique in the dance expression was solved from the unexploited point of view. Finally, we studied to determine the guidance of an existing dance with pursuing the enjoyment of dance itself, though it more focused on making up the original dance performance.

In addition, “Buyo-Kyouiku Kozouka Shian” was suggested from the result of teaching material in dance and now it’s been putting into practice.

[7-4]

**A thought about the characteristics of dance education  
of Japanese traditional dance**

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The purpose of the study is to clearly understand the characteristics of Japanese dance education with *nihon buyo*, Japanese traditional dance. Various literatures regarding Japanese traditional dances, *nihon buyo* and dance education are examined. Some interview documents and the author's experience as a *natori* are combined.

As for the dance education at school, the course of study does not carry any description on *nihon buyo*. The domain of dance in the course of study, after the latest revision which has made it coeducational, consists of creative dance, folk dance, and modern rhythm dance, the same as before. Under the category of folk dance, traditional Japanese folk dances/*minyo* and foreign folk dances are mentioned. The recent

trend, however, along with the introduction of "integrated study periods" and "Japanese culture and tradition" period set up by individual school at prefectural level, has had some classes of *nihon buyo* with invited professionals as guest teachers.

The characteristic of *nihon buyo* dance education, or the classic method of its lessons, is that it is one-on-one, copying, and not step-by-step. Although new lesson methods are emerging with the societal changes, it will be important to preserve the original lesson style of *nihon buyo* in professional dance education. (Supported by a Grant-in-Aid for Scientific Research (23531267) from the Japan Society for Promotion of Science.)

**[8. Sport Psychology/Neuroscience]**

**[8-1]**

**The analysis of movements in aerobic gymnastics to propose drills for beginners**

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Aerobic Gymnastics has not only been a popular form of physical training for the general public since the end of the 1980's, but also is a top-level competitive sport. The goal of the present research is to elucidate how well the beginners of Aerobic Gymnastics (AG) who are good at other sports can perform three basic movements of AG, with special focus on the effects of arm motions. Ten expert AG players and ten experts in other sports are asked to perform three basic movements with increasing difficulty: High Leg Kick (HK), Tuck Jump (TJ), and Turn. First, each subject performs 5 trials of each movement in a random order on barefoot. Then the subject is instructed about the arm motions and repeat the movements as in the first

session.

A Three Dimensional Motion Capture System consists of eight infrared cameras is used to determine 54 markers' positions at 200 Hz. A floor-mounted force plate is used to record the center of pressure (COP) at 1000 Hz. The kinematic parameters are (1) foot speed, hip and knee angular velocities, (2) the range of motions of hip flexion, knee flexion, and of ankle plantar flexion, (3) the duration of motion, (4) the center of gravity (COG) and COP, (5) trajectory of pelvis/ COG, area, length and max range of COP, (6) the ground reaction force. We have done preliminary experiments and some data will be presented in the symposium.

[8-2]

**Motor programming of response complexity and hand placement**

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The purpose of this study was to reveal the organization mechanism of motor programming, manipulating two motor-related factors. Sixteen students (mean age:  $22 \pm 2.8$  yrs) performed a choice reaction time task, in which they responded to the Chinese characters for left and right by pressing button(s) with their left and right fingers, respectively. We compared different response sequences (i.e., index vs. index→ring→middle fingers) and different hand placements (i.e., non-crossed vs. crossed). Both complexity ( $F(1,15)=69.2$ ,  $p<.01$ ) and hand-placement effects ( $F(1,15)=60.3$ ,  $p<.01$ ) on reaction time were significant, showing slower responses with more errors in the complex ( $F(1,15)=3.8$ ,  $p=.069$ ) and the crossed-hand ( $F(1,15)=8.7$ ,  $p=.01$ ) conditions. There was no interaction between response complexity and

hand placement. For ERPs, both complexity ( $F_c(1,15)=15.2$ ,  $p=.01$ ) and hand-placement ( $F_c(1,15)=1.96$ ,  $p=.04$ ) effects were obtained for the interval between response-locked LRP and response onsets. Only complexity effect ( $F_c(1,15)=17.2$ ,  $p=.01$ ) was revealed for the interval between EMG-locked LRP and response onset. These results indicate that the hand-placement effect resulted from central rather than peripheral processing. On the other hand, the stimulus-locked LRP latencies did not differ among conditions. Two separate motoric stages associated with response complexity and hand placement seemed to exist according to the additive factor method (AFM) logic. Our data support the motoric loci of response sequence complexity and hand placement effects.

[8-3]

**Effect of intensive resistance exercise on heart rate variability  
and polysomnogram during sleep**

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The aim of this study is to examine the effect of two consecutive days intensive resistance exercise on heart rate variability and polysomnogram during sleep. Ten young healthy males participated in the experiment consisting of three consecutive days. The first night was set for baseline night. Subsequent two nights were set as “Ex-1 day (second night)” and “Ex-2 day (third night)”, respectively. On the Ex-1 and Ex-2 day, the participants performed two bouts of intensive resistance exercises (morning and afternoon). During sleep (bedtime from 23:00-07:00),

electroencephalogram (EEG) and electrocardiogram (ECG) were continuously recorded. With respect to heart rate variability, there were no significant differences in all night, although there were significant differences in each sleep cycle between three nights. Consequently, these results indicate that two consecutive days intensive resistance exercise does not change the entirety of heart rate variability, while this exercise makes a big difference to autonomic activity in each sleep cycle.



[8-4]

**Muscle relaxation of the ankle reduces the corticospinal excitability of the wrist**

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Muscle relaxation is an important factor to make good performances in sports, but its mechanism is not well understood. Transcranial magnetic stimulation (TMS) study suggested that cortical inhibitory system is involved in muscle relaxation (Buccolieri et al., 2004). Purpose of the present study is to clarify the effects of relaxation of foot muscles on the activity of hand muscles. We examined how change the excitability of resting wrist muscle during the relaxation of the ipsilateral ankle from dorsiflexed position. Nine subjects performed relaxation of the right foot dorsiflexor from

dorsiflexed position immediately after an audio cue. TMS was given on the motor hand area of the left hemisphere at different timings before and after the onset of the relaxation. Motor evoked potentials (MEP) was recorded from the wrist extensor and flexor. The MEP amplitude of the wrist extensor and flexor became smaller than in the resting condition in the time periods of “50~100ms” and “100ms~” after the onset of relaxation. Relaxation of foot dorsiflexor, thus, produce decrease in excitability of hand muscles in both flexor and extensor.

[8-5]

**Acute moderate-intensity exercise at night slightly disturb sleep**

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Although many studies investigated the effect of acute exercise on sleep to measure by sleep-EEG, there are few studies to report changes in the peripheral parameters such as heart rate or core body temperature during sleep after exercise. The purpose of the study was to examine not only EEG sleep, but also peripheral physiological parameters. 6 Healthy young male subjects, who are sedentary nonsmokers, underwent the 2 experimental conditions (control, exercise) consisting of 2 nights. The first night was adaptation night in the both conditions. Sleep time was 8 hours (11pm-7am). On the exercise condition, subjects started 60-minutes

cycle ergometer exercise at 60%VO<sub>2</sub>max at 7:30pm. On the control condition, subjects relaxed by watching TV and reading books. We recorded sleep-EEG, heart rate, respiratory rate, and rectal temperature. In addition, blood glucose level, blood lactate level, sleepiness, and subjective fatigue were measured before and after exercise and sleep. Slow-wave sleep slightly decreased in exercise condition than in control condition. Heart rate was higher during the first 2 sleeping hours in exercise condition than in control condition. In conclusion, acute moderate-intensity exercise increase heart rate during sleep, which may slightly disturb sleep.

[8-6]

**Five days sleep shortage alters vigilance performance and EEG during sleep**

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**Introduction:** In this study, we examined physical and vigilance performance to investigate how sleep shortage affect physical functions. **Methods:** Subjects were six healthy young students. In order to measure regular sleep length, subjects wore wrist actigram for 14 days. Experiment was performed on two conditions (regular sleep condition: RSC, sleep deprivation condition: SDC). Exercise performances (EX) (aerobic and anaerobic) and Psychomotor Vigilance Test (PVT) were examined in the RSC and the SDC. **Result:** There were no significant differences in exercise performances. While PVT impaired by continuous sleep shortened. Number of lapse (RT >500ms) and mean reaction time (exclude lapse) have an increasing ( $p<0.05$ ). Moreover result of PVT suggested that there is individual difference in relation between

sleepiness and vigilance performance. Sleep variables were significantly different in the sleep consecutive deprivation conditions. Time of sleep stage 1 decreased and time of slow wave sleep increased in the sleep deprivation conditions ( $p<0.05$ ). Moreover frequency analysis revealed that total delta power density increased by sleep deprivation. **Conclusion:** Results of experiment suggested that five nights shortened sleep didn't affect exercise performances. While vigilance performance impaired by five days shortened sleep. However it may be because improved sleep quality compensated brain function. Because continuous sleep shortage alters sleep quality that total delta power increased. The reason why it is suggests that slow wave sleep related recovery of central nerve system.

[8-7]

**The effect of a daytime 2-hour nap on complex motor skill learning**

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We examined the complex motor skill learning close to sport performance could be enhanced by sleep. Additionally, we investigated which sleep EEG component is directly related to this memory consolidation process. Subjects were 16 female college students. They were divided into nap group and control group. All subject practiced juggling for 15min, and juggling technique was evaluated at 1030h. Nap group took a 2h nap from 1400h while control group stayed awake. Both groups retested juggling at 1730h. One week before these experiments, nap group had taken 2h nap in the same environment as a baseline nap condition. Sleep EEG was recorded at 6 scalp sites (Fz, Cz, Pz, Oz, C3, C4). EEG was subjected to fast Fourier transform analysis (FFT). Spindles were

detected automatically using spectral analysis technique and image analysis technique. Nap group improve the juggling performance after 2h nap ( $p < .001$ ). Compared to the baseline nap, slow wave sleep (SWS) duration was significantly increased after motor learning ( $p < .05$ ). FFT revealed that slow oscillation (0.3-1.0Hz) power and sigma EEG (12-16Hz) power significantly increased during SWS after motor learning. Number of spindles during SWS increased in nap after motor learning compared to baseline. Sleep facilitates memory consolidation in three-ball cascade juggling. Our results suggested that increasing slow oscillation and spindle activities during SWS are related to the complex motor memory consolidation process.

[8-8]

**Anticipation skill of World Soft Tennis Champion**

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We examined the anticipation skill of the men's doubles Winner in the 14th MUNGYEONG World Soft Tennis Championships by using temporal occlusion paradigm and eye movement recording system. In the experiment 1, we examined the world champion player and 16 skilled soft tennis players about the accuracy of anticipating shot directions. The participants viewed 100 video clips in the five occluding conditions. The participants scored their anticipatory judgment of the ball direction on a pen-paper method, respectively. The results were that the world

champion player was faster and more accurate than those skilled players in anticipating the direction of opponents' tennis strokes. In the experiment 2, we attempted to clarify the eye movement behavior strategy of the world champion player by comparing with 16 skilled players. The participants wore a head mounted eye mark recorder and viewed 40 video clips. The world champion player places his attention longer on impact zone by the time an opponent started forward swing. In conclusion, our study suggested that the world champion player had more effective visual search behavior.

[8-9]

**Changes of the human core body temperature rhythm and sleep structure by 6-hour phase advance treatment under a natural light-dark cycle**

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This study was strategy to reduce eastward jet lag. The extremities of core body temperature rhythm shifts and nocturnal sleep structure changes were examined during six days of 6-hour phase advance treatment using bright light and melatonin under the natural light-dark cycle.

Six healthy males received phase advance treatments with 1 hour bright light exposure after waking, oral melatonin (1.0 mg) administered in the early evening, and advancement of environmental routines intended to advance the onset of the sleep period 1 hour per day. Core body temperature was recorded continuously for 8 days comprising adaptation, baseline, and 6 treatment days. Nighttime sleep quality was evaluated by PSG on adaptation, baseline, night

3, and night 6.

The core body temperature nadir in each day compared with baseline advanced significantly ( $p < 0.05$ ). The mean nadir had advanced approximately 4.5 hours from baseline by day 6. The only significant change found in sleep structure was REM sleep duration, which was significantly decreased in day 6 compared with baseline ( $p < 0.05$ ). Significant negative correlations existed between nadir phase advances and %REM in baseline, day 3, and day 6 recordings. Thus, phase advances greater than 4 hours were possible under natural light-dark condition, although a phase shift of 1 hour per day may be too rapid to maintain normal sleep structure.

[8-10]

**Modulation of corticospinal excitability depends on imagined force level**

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Motor imagery is defined as the mental execution of a movement without any muscle activity. Corticospinal excitability was assessed by motor evoked potentials (MEPs). Electromyography (EMG) activity was recorded from the right brachioradialis, the biceps brachii and the triceps brachii muscles. First, the maximum voluntary contraction (MVC) of elbow flexion was recorded in each subject. Subjects practiced to perform the calculated 10%, 30% and 60% MVC. After the practice, the MEPs were recorded during the imagery of elbow flexion with the forces of 10%, 30%, 60% or 100% MVC. After MEPs recording, we assigned subjects to reproduce the actual elbow flexion at

the 10%, 30%, 60%, and 100% MVC, and confirmed the learning effects of the force production task. The MEPs amplitude in the brachioradialis in the 60% MVC condition was significantly greater than that in the 10% MVC condition ( $p < 0.05$ ). The MEPs amplitudes in the biceps brachii had similar tendency to those in the brachioradialis among the conditions. On the other hand, the MEPs amplitudes in the triceps brachii were not modulated by imagined force level. These findings suggest that we can grade the force level even in motor imagery. In addition, modulation of corticospinal excitability would be caused only in agonist muscles but not in antagonist.

[8-11]

**Reafferent potential associated with a timing control skill**

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Earlier studies of the movement-related cortical potentials suggested that positivity elicited by a self-paced skilled-movement should represent the evaluation or the control activity of performance. The positivity peaking about 450 ms after the EMG is referred to as the skilled-performance positivity (SPP) (Papakostopoulos, 1978). Previous studies found larger SPPs over frontal and precentral regions for a good performance of a skilled performance task (SPT), in which participants started a sweep of the oscilloscope trace with the left thumb and stopped it in the target position area (corresponding time-interval between 40 and 60

ms) with the right thumb. Although the SPP was suggested to be a good tool to evaluate the timing control skill, further studies are needed to confirm the utility of this component. This study was designed to clarify the functional significance of the SPP. We compared three conditions in a SPT; (1) the unskilled movement condition, (2) the SPT, and (3) the SPT with delayed-feedback condition. Our results suggested that the increased SPP was due to P300 elicited by the visual feedback. It is concluded that the SPP does not represent the timing control skill per se.



[8-12]

**The effect of synchronous music on mood and cycling economy during aerobic exercise**

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The purpose of this study was to investigate the effect of listening music during aerobic exercise on physiological and psychological parameters, and exercise performance.

Ten healthy female subjects participated in this study. All of them did not have a menstrual irregularity and did not exercise more than three times a week. They took cycling exercise with music at 60%VO<sub>2</sub>max and 65rpm for 30 minutes (music condition), and they also did the same exercise with the metronome (control). These two conditions were separated by three days. In both conditions, rates of perceived exertion (RPE), pedaling rhythm and VO<sub>2</sub>/min were measured during exercise. Mood was measured before and after exercise.

RPE showed significantly low score throughout exercise in music condition compared to the control ( $p < 0.05$ ). Active moods in music condition significantly increased before and after exercise ( $p < 0.05$ ). Pedaling rhythms during exercise showed significant faster trend from 5min to 25min after exercise started in music condition ( $p < 0.1$ ), whereas control did not change. There were no differences in VO<sub>2</sub>/min between both conditions.

These results indicated listening music reduced subjective fatigue during exercise, and could improve the mood before and after exercise. Further, it suggested listening music during exercise could improve cycling economy.

[8-13]

**Baseball players have greater tactile sensitivity of finger tips**

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Baseball is played with a ball held in the hand. We hypothesized that baseball players would be good at perceiving tactile stimuli. To test this hypothesis, we measured baseball players' ability to discriminate two stimuli applied to the thumb and a finger. We also measured non-players. Subjects held an 80mm diameter styrene foam ball in the right hand. The thumb and index finger or the thumb and ring finger were set on braille-like devices with 2 arrays of 4 pins. Each pin could be separately stuck out 0.7mm. Randomly assigned numbers of pins were stuck out every 400, 600, or 800 msec. Subjects had to quickly judge which finger of the

two was stimulated with a greater number of pins. Baseball players judged the stimuli applied to the thumb and the index finger significantly more accurately than non-players ( $F_{1, 20}=5.473$ ,  $p<0.05$ ). No difference was observed between the players and non-players in the task involving the thumb and "the ring finger," which is not used in throwing a baseball. The higher sensitivity of baseball players' ability to discriminate stimuli to the thumb and index finger is likely due to the importance of these digits in controlling the speed and accuracy of the throw.

[8-14]

**The effect of leadership behavior and motivational climate  
on the goal orientations of Japanese high school ice hockey players**

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This study aimed to examine the effect of coaches' leadership behavior and the perceived motivational climate created by coaches on players' goal orientation among Japanese high school ice hockey players. One hundred and eighty-eight players completed a questionnaire survey in September 2010, which fell in the middle of the athletic season. Respondents were recruited from the 27 teams that participated in the national high school ice hockey tournament in January, 2010. The research items included 1) background information (e.g., age, position and years of ice hockey experience), 2) coaches'

leadership behavior, 3) motivational climate, and 4) goal orientations. Path analysis was used to examine the predictor of goal orientations. Path analysis revealed that, through motivational climate, leadership behavior indirectly predicted goal orientations rather than directly predicted, whereas motivational climate directly predicted goal orientations. In conclusion, these results highlight that it is important for coaches to create a motivational climate to change players' goal orientation. Furthermore, leadership behavior plays a critical role in the creation of a motivational climate.

[8-15]

**The difference of behaviors between ipsilateral and contralateral combination  
in coordinated movements using two limbs**

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We perform the complex actions that require the coordination of multi-limb movements. According to previous studies, the difficulty appears when moving two limbs simultaneously in the “different direction”, while it almost never appears in the same direction. Additionally, the difficulty depends on the combination of two limbs. For example, ipsilateral two-limb movements are more difficult than contralateral two-limb movements. To investigate the difference of motor control systems between these two types of combination, we compared the behaviors between ipsilateral and contralateral hand-foot coordinated movements. In each combination includes two conditions. One condition is the performance of two limbs

actively-moved by a subject. The other condition is the performance of one limb actively-moved which coordinated to another limb passively-moved by an experimenter. In the former condition, ipsilateral coordination was difficult to perform than contralateral coordination. However, the performances between ipsilateral and contralateral coordination appeared no difference in difficulty in the latter condition. These results indicates that the behaviors become almost the same when attending the feedback information about moving limb in any combination of two limbs, and the neural mechanisms of voluntary movements differ substantially depending on the combination of two limbs.

[8-16]

**Response inhibitory processing in somatosensory Go/No-go paradigms:  
Effects of stimulus probability and time-on-task**

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We performed two experiments to clarify the characteristics of response inhibitory processing in somatosensory go/no-go task by measuring event-related potentials (ERPs). We investigated the effect of stimulus probability in experiment 1, and the effect of time-on-task in experiment 2.

Electrical stimulation was delivered to the second (go stimuli) and fifth digit (no-go stimuli) of left hand. The subjects were asked to respond by pushing a button with their right thumb. In experiment 1, we set three conditions; (1) 20%: 80% (go: no-go), (2) 50%: 50%, and (3) 80%: 20%. In experiment 2, the probability of go and no-go stimuli was even, and seven sessions were repeated. The interval

between sessions was set at 5 min.

In experiment 1, we found that the amplitudes of go-N140, go-P300 and no-go-P300 increased with decreasing of stimulus probability. However, there was no such effect on the amplitude of no-go-N140. In experiment 2, the amplitude of go-N140 decreased with repeating session, but that of no-go-N140 did not.

Our findings suggested that the effects of stimulus probability and time-on-task affected the amplitudes of go-N140, go-P300, and no-go-P300. In addition, since the amplitude of no-go-N140 was not affected in both experiments 1 and 2, brain activities generating no-go-N140 was independent from these effects.

[8-17]

**The effects of pre-batting swing-like isometric contraction conditioning on baseball bat swing**

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Speed and accuracy of bat swing are the essential component of baseball batting performance. The purpose of this study was to find an optimal pre-batting warm-up method. It was hypothesized that a warm-up method utilizes swing-like isometric contraction conditioning (ISO) promotes acute increase in batter's swing speed since the isometric contraction conditioning enhances the rate of force development for several kinds athletic movement (e.g., jumping and kicking). Twenty-three collegiate baseball players participated in this study. Eight weeks of familiarization period for ISO was assigned to twelve subjects as an

experimental group. Eleven subjects in a control group refrained from performing ISO for eight weeks. All subjects performance in tee batting (5 hits) before and after three kinds of warm-ups (5 standard bat swings; 5 WBS; or 4 sets of ISO for 5 s) were measured before and after the eight weeks of training period. The rate of increase in bat swing speed after ISO in experimental group was significantly greater than that of control group (102.0 % vs. 100.6 %, respectively) ( $p < 0.05$ ). No effect of any warm-ups on the bat swing accuracy was observed. It was suggested the pre-batting warm-up with ISO can enhance batting performance.

[8-18]

**The effect of gaze shift in preference decision of football shirts**

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In daily life, we often gaze the thing because we like it. However, Shimojo et al. (2003) reported that if one gazes at something, he/she comes to prefer it. But, little is known about the individual factors, that is, how individuals are familiar with and interested in presented stimuli in the effect of gaze shift in preference decision. Here we investigated the relationship between individual factors and the effect of gaze shift in preference decisions of football.

In our experiment, pictures of football shirts were shown alternatively on each side of the screen, one for 900 ms and the other for 300 ms. Participants shifted their gaze toward the

pictures on the screen under the “gaze shift” condition while they maintained gaze at the center of the screen under the “no gaze shift” condition. And the participants also answered questionnaires about their preferences for football, fashion and years of football experience.

When we analyzed the rates of choosing stimuli presented longer in relation to their football experience, the effect of gaze shift was significant for the participants who have football experience. Our results suggest that the effect of gaze shift in preference decisions can be increased through sport experience.

[8-19]

**Effects of acute aerobic exercise on executive control function in young adults**

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The purpose of this study was to investigate the effect of acute aerobic exercise on executive control function in young adults using event related potentials (ERPs). Thirty healthy young adults (21.3±1.3 years) participated in this study. Participants performed a task switching paradigms which involve switching between two different tasks, after 30 minutes of moderate-intensity (60% VO<sub>2</sub>max) exercise on a treadmill (exercise session) and a seated rest (baseline session) respectively. The order of sessions was counterbalanced among the participants to minimize potential practice effects. Behavioral performance (reaction time (RT), response accuracy), P3 latency, and P3

amplitude were measured as indicators for executive control function. RT was shorter following exercise session compared to the baseline session ( $p < 0.05$ ), but response accuracy did not differ between sessions. P3 latency was shorter for the exercise session than the baseline session ( $p < 0.01$ ), suggesting that acute aerobic exercise might facilitate speed of stimulus evaluation in switch trials. Furthermore, P3 amplitude was larger following exercise session compared to the baseline session ( $p < 0.01$ ). These findings suggest that 30 minutes of moderate-intensity exercise improves executive control function including working memory and mental flexibility.



[9. Sport Physiology]

[9-1]

**The effects of low-volume exercise and vitamin E supplementation  
on oxidised low-density lipoprotein in older adults**

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The purpose of this study was to investigate the effects of 12 weeks of low-volume walking programme below the current recommended amount of exercise (< 150 min/week) and vitamin E supplementation on oxidised low-density lipoprotein (LDL) in older adults. Thirty-eight older (60 – 81 years) participants were assigned into one of four groups; 1) control (n = 14), participants were advised to maintain their normal lifestyle during the study, 2) supplementation (n = 10), 3) walking (n = 7), or 4) walking + supplementation (n = 7). Both supplementation and walking + supplementation groups, participants received vitamin E supplement ( $\alpha$ -tocopherol, 300 mg/day) for 12 weeks. Exercise programme of walking and walking + supplementation groups consisted of

walking 30 - 60 min/session on 2 days of the week for 12 weeks (average walking time,  $44.5 \pm 1.6$  min/session). Blood samples were collected at baseline and immediately after 12 weeks. No significant changes were observed in plasma oxidised LDL concentrations. Plasma thiobarbituric acid reactive substances (a marker of oxidative stress) concentrations were significantly decreased in all intervention groups compared with the control group (2-factor ANOVA,  $P = 0.001$ , an interaction effect). These data demonstrate that low-volume walking exercise and vitamin E supplementation, at least in our study, had no effect on oxidised LDL. However, walking and/or vitamin E intake may protect against oxidative stress in older adults.

[9-2]

**Effects of continuous versus intermittent low intensity exercise  
on fat utilization and appetite**

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Low fat utilization leads to increased appetite through carbohydrate imbalance. As a result, difference of fat utilization may cause individual variation of weight gain. Although several reports have indicated that increased physical activity level and exercise modify fat utilization, there is no evidence whether physical activity patterns (e.g. intensity, mode, continuity) influence fat utilization or not. We hypothesize that intermittent exercise utilizes ingested fat efficiently compared with continuous exercise, while total energy expenditure and exercise intensity are the same. The purpose of the present study is to examine whether continuous and intermittent low intensity exercise differently influence fat utilization, appetite

score and subsequent appetite drive. This is a randomized, cross-over designed study. Each participant performs two, 39 hours sessions (2 nights 3 days) in a respiratory chamber to measure energy expenditure and substrate oxidation. Energy expenditure and substrate utilization are evaluated every 15 minutes based on measurements by two mass spectrometers. Appetite score is obtained by a visual analog scale every 1 hour. Subjects consume high-carbohydrate meals corresponding to predicted dairy total energy expenditure for 3 days before entering the respiratory chamber, and 4 high-fat meals corresponding to predicted total energy expenditure in the respiratory chamber. We are still working on collecting data.

[9-3]

**Effects of different modes of exercise on appetite  
and appetite-regulating hormones in young men**

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This study was to compare the effects of weight-bearing (i.e. cycling) and non-weight-bearing (i.e. rope skipping) exercises on appetite and plasma concentrations of acylated ghrelin and PYY. METHODS: Fifteen healthy young men ( $24.4 \pm 0.4$  yrs, mean  $\pm$  SEM) participated in this study. After 12-h of fasting, all subjects undertook three, 160 min trials, 1) rope skipping exercise ( $293 \pm 11$  kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 2) bicycle ergometer exercise ( $287 \pm 9$  kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 3) control (rested for 160 min). Plasma concentrations of acylated ghrelin and PYY, and hunger evaluated by visual-analog scale (0 mm Not Hungry – 100 mm Very Hungry) were measured throughout each three trial. RESULTS:

Two-way ANOVA revealed significant ( $P < 0.05$ ) interaction effects for hunger and plasma concentrations of acylated ghrelin and PYY, indicating suppressed hunger and acylated ghrelin concentrations, and increased PYY concentrations during both rope skipping and bicycle ergometer exercises. Furthermore, the rope skipping exercise trial showed lower hunger rating compared with the bicycle ergometer exercise and control trials, but not plasma concentrations of acylated ghrelin and PYY. CONCLUSION: These results indicated that rope skipping exercise may have greater effect of exercise-induced suppression of appetite but not of acylated ghrelin compared with bicycle ergometer exercise.

[9-4]

**Acute effects of stretching exercise on arterial stiffness**

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Poor flexibility is associated with arterial stiffening. Currently, it is unknown whether stretching exercise induces favorable changes in the arterial stiffness.

The purpose of this study was to determine the acute effects of stretching exercise on arterial stiffness. Nine healthy adults (2 men and 7 women, age  $24 \pm 1$  yrs) were studied separately under parallel experimental trials on two days. The order of experiments was performed randomly between stretching exercise (40 stretching exercises for whole body at maximum range of motion) and sham control (seated rest in the exercise room). Arterial stiffness (baPWV; brachial-ankle pulse wave velocity) was measured before and immediately after the

stretching exercise as well as 15, 30, 45, 60 minutes after the stretching exercise. Baseline baPWV was not different between the two experimental trials (Stretching;  $979 \pm 44$  vs. Control;  $965 \pm 39$  cm/s,  $P > 0.05$ ). The baPWV significantly decreased 45 and 60 minutes after stretching exercise (45 min;  $933 \pm 35$ , 60 min;  $933 \pm 31$  cm/s,  $P < 0.05$  respectively). In contrast, during the sham control trial, no significant changes in baPWV were observed. These results indicate that stretching exercise decreases acutely arterial stiffness, suggesting that to improve flexibility induced by stretching exercise may be capable of modifying arterial stiffening.

[9-5]

**The effects of menstrual cycle and carbohydrate ingestion on immune responses during the prolonged exercise in hot environment**

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The purpose of this study was to examine whether menstrual cycle and carbohydrate ingestion affect the circulating leukocyte counts during a prolonged exercise in a hot environment. Six healthy women with regular menstrual cycle completed total of four trials which consists of 90 min of cycling exercise at the intensity of their 50% VO<sub>2</sub>peak with the performance test afterwards in a hot environment. Each trial was performed both at their follicular phase (FP) and luteal phase (LP) with the ingestion of carbohydrate drink or the placebo drink pre and during exercise, respectively. The data of the concentration of expired gas, heart rate, and

rectal temperature were collected during the exercise. Blood samples were taken before and after exercise and every 30 min during exercise. The results in this study were that 1) menstrual cycle affected the leukocyte counts during prolonged exercise in a hot environment, about 37% higher in LP as contrast with in FP at 90th min of exercise, 2) ingestion of carbohydrate drink during exercise suppressed the acute increase of leukocyte and diminished the difference in increase of leukocyte counts between FP and LP, 3) there were no difference on cytokine levels in the blood between the two menstrual cycle phases.

[9-6]

**The effect of endurance exercise in the morning and evening on lipid metabolism**

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The purpose of this study was to compare the effects of endurance exercise in the morning and evening on lipid metabolism in young men. Ten male participants, aged  $23.0 \pm 2.1$  years (mean  $\pm$  SD), completed morning (0900-1000) and evening (1700-1800) trials in each other days separated at least by week. These trials were conducted in a randomized order. In both the morning and evening trials, participants walked for 60 minutes at approximately 60% of maximal oxygen uptake on the treadmill. Breath-by-breath measurements were used to analyze expired gases continuously. Blood samples were taken at pre-exercise, immediately

after exercise and 2-hour after exercise. Serum free fatty acids concentration was significantly higher in the evening trial than morning trial 2-hour after exercise (2-way ANOVA, group $\times$ time interaction,  $P < 0.01$ ). Plasma adrenaline concentration was significantly higher immediately after exercise in the evening trial (2-way ANOVA, group $\times$ time interaction,  $P < 0.05$ ). Fat oxidation was similar between the morning and evening trials. These findings suggest that exercise in the evening is more effective on lipolysis in young men. However, the exercise-induced fat oxidation is not influenced by time of day.

[9-7]

**Inter-muscle differences in architectural changes  
of the quadriceps femoris induced by resistance training**

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The purpose of this study was to clarify whether resistance training-induced changes in muscle architecture are homogeneous among four muscles of the quadriceps femoris. Eleven healthy men completed a resistance training program of unilateral knee extension for 12 weeks (3 days per week). Before and after the training, the muscle thicknesses, fascicle lengths, and pennation angles of the four muscles were measured using ultrasonography. Anatomical cross-sectional areas (ACSAs) at the same positions as the ultrasound measurements were also determined from magnetic resonance images. The ACSAs of all muscles increased after training. Except for the lateral portion of the

vastus intermedius, significant increases in muscle thickness and pennation angle were observed in each muscle after training, while fascicle length did not change. Relative increases in ACSA, muscle thickness, and pennation angle of the rectus femoris were significantly higher than those of the vasti (e.g. for ACSA, rectus femoris: 24%, vastus lateralis: 11%, vastus medialis: 11%, and vastus intermedius: 6%). These results indicate that changes of muscle architecture induced by knee extension resistance training are not uniform among the four muscles of the quadriceps femoris.

[9-8]

**ACTN3 and ACE genotypes in elite Japanese track and field athletes**

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The purpose of the present study was to investigate whether *ACTN3* R577X and *ACE* I/D polymorphisms are associated with elite Japanese track and field athlete status. 298 elite Japanese track and field athletes (133 sprint/power athletes: SPA [sprinters, jumpers and throwers]; 165 middle-power/endurance athletes: MEA [middle- and long-distance runners]) and 649 Japanese population controls (CON) were genotyped for *ACTN3* R577X and *ACE* I/D polymorphisms using TaqMan Genotyping Assay. Allele and genotype frequencies were compared among groups by a Chi-square test. For *ACTN3* R577X polymorphism, the frequency of the R allele was significantly higher in SPA than in CON (0.538

vs. 0.470,  $P = 0.044$ ); there was no significant difference between MEA and CON (0.497 vs. 0.470,  $P = 0.380$ ) and between SPA and EMA (0.538 vs. 0.497,  $P = 0.324$ ). SPA showed a higher frequency of RR+RX genotype than CON (110/133 [82.7%] vs. 478/649 [73.7%],  $P = 0.027$  under the R dominant model). Further subgroup analysis dividing the SPA into sprinters ( $n=85$ ) and jumpers ( $n=35$ ) revealed a higher RR+RX genotype frequency in sprinters than in CON (73/85 [85.9%] vs. 478/649 [73.7%],  $P = 0.0143$  under the R dominant model). No association was found for *ACE* I/D polymorphism in elite Japanese track and field athletes. These results suggest that *ACTN3* R577X polymorphism has an influence especially on sprint performance.



[9-9]

**Effects of maximal exercise in the morning and evening  
on subjective mood during sleep deprivation**

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**Objective:** The purpose of this study was to investigate the effects of maximal exercise in the morning and evening on subjective mood during sleep deprivation. This study was a pilot study for clarifying the effects of moderate intensity exercise on stress markers and mood after overnight work.

**Methods:** Eighteen healthy males participated in this study. Participants were divided into morning exercise (n = 8) and evening exercise (n = 10) groups and completed 2-day protocol each. All participants performed maximal exercise in the morning or evening on day 2 after sleep deprivation. The subjective mood was measured by profile of mood state and visual analogue scale in the evening on day 1 and before and after maximal exercise on day 2 in both groups.

**Results:** The subjective fatigue and vigor scores from evening on day 1 to morning on day 2 were deteriorated by sleep deprivation in both morning and evening exercise groups, but these scores did not differ between the groups. The subjective vigor score obtained after maximal exercise on day 2 was increased in only the evening exercise group. However, the other mood scores were not changed by maximal exercise in both groups.

**Conclusion:** These results suggest that maximal exercise improves subjective vigor state deteriorated by sleep deprivation in the evening. We are currently examining the effects of exercise on stress markers and mood after overnight work.

[9-10]

**Does cardiorespiratory fitness modify the association  
of low birthweight with metabolic risk?**

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We examined the association of birthweight and metabolic syndrome (MeS) risk factors, and how the association is influenced by cardiorespiratory fitness (maximal oxygen uptake, VO<sub>2</sub>max) in 336 Japanese aged 20-59. They had participated in our previous research, in which VO<sub>2</sub>max and MeS risk factors (abdominal circumference, blood pressure, triglycerides, HDL cholesterol, the homeostasis model assessment of insulin resistance (HOMA-R), and smoking status) were assessed. HOMA-R was calculated according to the following equation: Fasting glucose (mg/dL) × fasting insulin (μU/mL) / 405. In this study, birthweight was obtained by mail-survey. The reply rate of this survey was 41% and the completed questionnaires of subjects were 336.

Multiple linear regression analysis revealed that birthweight was significantly associated with HOMA-R even after adjustment for sex, age, and other MeS risk factors ( $\beta = -0.15$ ,  $P < 0.01$ ). Further adjustments for VO<sub>2</sub>max does not attenuate the relationship between birthweight and HOMA-R ( $\beta = -0.16$ ,  $P < 0.001$ ), although VO<sub>2</sub>max ( $\beta = -0.29$ ,  $P < 0.001$ ) was a stronger predictor of HOMA-R than birthweight.

These results indicate that low birthweight is associated with increased insulin resistance in Japanese. This association would not be offset by increased cardiorespiratory fitness. However, maintenance of cardiorespiratory fitness may reduce insulin resistance independently of their low birthweight.

[9-11]

**Exercise training inhibits hepatic inflammation and fibrosis by suppressing macrophage infiltration during diet induced-obesity in mice**

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Nonalcoholic steatohepatitis, which is considered the hepatic event in metabolic syndrome, was recently associated with the innate immune system. Although regular exercise reduces plasma levels of hepatic injury markers, the mechanisms regulating the effects of exercise on steatohepatitis are unclear. This study aimed to clarify whether exercise training suppresses hepatic injury, inflammation and fibrosis by suppressing macrophage infiltration. Mice were randomly divided into 4 groups: normal diet (ND) control, ND with exercise training, high-fat diet and high-fructose water (HFF) control, and HFF with exercise training. The exercise group was trained on a motorized treadmill for 60 min/day, 5 times/week. Exercise training significantly attenuated liver triglyceride accumulation in HFF mice. The

nonalcoholic fatty liver disease activity score and plasma alanine aminotransferase activity, indicators of liver injury, were increased in HFF control mice but were attenuated in HFF with exercise training mice. Hepatic inflammation, indicated by hepatic tumor necrosis factor- $\alpha$  levels and hepatic resident macrophage infiltration, was significantly lower in HFF with exercise training mice than in HFF control mice. Histological hepatic fibrosis detected by Sirius red and  $\alpha$ -smooth muscle actin staining, transforming growth factor- $\beta$  and tissue inhibitor of matrix metalloproteinase-1 mRNA were attenuated in HFF with exercise training mice compared with HFF control mice. Exercise training may reduce hepatic inflammation, injury and fibrosis by suppressing macrophage infiltration.

[9-12]

**Fat oxidation during and following exercise: focused on intensity of maximal fat oxidation**

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Fatmax is the exercise intensity which elicits maximal fat oxidation during exercise. Whereas, over moderate intensity exercise elicits increasing fat oxidation during post-exercise. Thus the intensity which elicits maximal total fat oxidation of during and following post-exercise is unknown. The purpose of this study was to compare the effects of Fatmax and over moderate intensity on substrate oxidation rate during and post-exercise in young men. Eight men (mean  $\pm$  SD aged  $21.4 \pm 1.3$  years, peak rate of oxygen consumption ( $VO_{2peak}$ )  $65.8 \pm 6.5$  ml/min/kg, Fatmax  $37.3 \pm 4.6$  % $VO_{2peak}$ ) performed exercise on the treadmill at Fatmax for  $53 \pm 6$  min and 65% $VO_{2peak}$  for 30 min matched for energy expenditure on separate days. After exercise participants rested sitting on the chair

for 2h. During and following post-exercise period 2h were determined with indirect calorimetry to evaluate substrate oxidation rate. Total amount of energy expenditure was not significantly different (Fatmax  $357.4 \pm 47.9$  kcal, 65% $VO_{2peak}$   $361.5 \pm 41.9$  kcal). Net fat oxidation during exercise Fatmax was significantly higher than 65% $VO_{2peak}$  ( $15.6 \pm 5.1$  g,  $8.0 \pm 3.4$  g), but during post-exercise both trials were not significantly different ( $7.8 \pm 3.4$  g,  $8.7 \pm 2.6$  g). Hence total net fat oxidation of during and following post-exercise Fatmax was significantly higher than 65% $VO_{2peak}$  ( $23.4 \pm 7.6$  g,  $16.6 \pm 4.8$  g). These findings suggest that Fatmax is more effective intensity for fat oxidation than 65% $VO_{2peak}$  in equally energy expenditure.

[9-13]

**Influence of the behavior of fascicle during twitch contraction  
on the extent of postactivation potentiation in vivo**

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Twitch torque is increased after a high intensity contraction (conditioning contraction). This phenomenon is called postactivation potentiation (PAP). The purpose of this study was to examine influence of the fascicle behavior of the gastrocnemius during a twitch contraction on the extent of PAP. For 15 male subjects, a twitch contraction of plantar flexion was elicited at the same ankle joint angle (0°) while the joint was fixed (isometric condition) and passively plantar-flexed (passive shortening condition) and dorsi-flexed (passive lengthening condition) before and immediately after the maximal voluntary isometric conditioning contraction of plantar flexion. During a twitch contraction, the behavior of the fascicle of the

medial gastrocnemius was determined by ultrasonography. As a result, The extent of PAP in isometric condition was significantly smaller than that in passive shortening condition, but significantly larger than that in passive lengthening condition ( $p < 0.05$ ). Likewise, the shortening velocity of the fascicle of the medial gastrocnemius during the twitch contraction in isometric condition was significantly smaller than that in passive shortening condition, but significantly larger than that in passive lengthening condition ( $p < 0.05$ ). These results indicate that the extent of PAP is related with the shortening velocity of the fascicles during a twitch contraction.

[9-14]

**Effect of static and dynamic stretching on muscle hardness and stiffness**

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**Purpose:** Static stretching improves muscle flexibility. Muscle tension involves muscle hardness determined by palpation of the body surface and stiffness that represents flexibility in the direction of the muscle fiber. The study aimed to determine whether static and dynamic stretching affected muscle hardness and stiffness.

**Method:** Six healthy men participated in this study involving static and dynamic stretching. Resting for 5 min with no stretching was the control. Muscle hardness was measured by two methods: a push-hit hardness meter (NEUTONE) and ultrasonography (elastography: EUB-7500). Three times measurements were performed for

each method, and the mean values were calculated. The rectus femoris (RF) and vastus medialis (VM) were the measurement points. Flexibility tests such as the sitting-toe-touch and buttock rising tests were used for measuring muscle stiffness.

**Results & Discussion:** Static and dynamic stretching affected muscle hardness and stiffness. Ultrasonography revealed that muscle hardness decreased at RF but increased at VM. On the other hand, muscle stiffness improved at RF but no change was observed at VM. These results suggest that changes in muscle hardness may correlate with changes in muscle stiffness.

[9-15]

**Effects of low-intensity resistance exercise with blood flow restriction on high-energy phosphate metabolism and tissue oxygenation in human skeletal muscle**

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The purpose of this study was to evaluate the effects of low-intensity resistance exercise with blood flow restriction (BFR) on high-energy phosphate metabolism and oxygenation in human skeletal muscles. Seven men performed dynamic ankle plantar flexion exercise (30% one repetition maximum) using a non-magnetic, custom-made device for 4 min (30 repetitions/min) with and without BFR (130% of systolic blood pressure) inside the bore of a 1.5T MR device. Inorganic phosphate-to-phosphocreatine (Pi/PCr) ratio and intracellular pH in the medial gastrocnemius before, during, and after the exercise were determined using <sup>31</sup>P-MR spectroscopy. Concentration changes in oxygenated, deoxygenated, and total hemoglobin/myoglobin

in the medial gastrocnemius were determined using near-infrared spectroscopy. Pi/PCr ratio significantly increased at 1–4 min in both the exercise conditions, with the BFR-condition values being greater than the control-condition values. Intracellular pH significantly decreased during exercise in the BFR condition but remained unchanged in the control condition. Moreover, the BFR condition showed markedly decreased oxygenated and increased deoxygenated hemoglobin/myoglobin concentration during the exercise compared with the control condition. Thus, low-intensity resistance exercise with BFR placed greater stress on high-energy phosphate metabolism and oxygenation in muscles than exercise with normal blood flow.

[9-16]

**Effects of the menstrual cycle and acute aerobic exercise on salivary stress markers**

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The aim of this study was, (1) to investigate the effects of menstrual cycle on the basal levels of salivary stress markers in young women and (2) to study the effects of aerobic exercise at ventilatory threshold (VT) on changes in salivary and circulating inflammatory cytokines. Eight healthy women participated in five separate testing sessions: three sessions were conducted for the baseline measurements during their menstrual cycle phases; two sessions were conducted at a separate menstrual period, and included 60-min cycling at VT, and a resting control session. The unstimulated saliva was collected for determination of hormones and cytokines. We measured the concentrations of

salivary hormones (17 $\beta$ -estradiol, progesterone, cortisol and dehydroepiandrosterone (DHEA)), inflammatory cytokines (interleukin (IL)-6, IL-8 and tumor necrosis factor (TNF)- $\alpha$ ) and total protein. The main findings of this study are: (1) there are significant changes in salivary IL-6 levels during the menstrual cycle; (2) aerobic exercise significantly increased absolute salivary IL-8 levels, however there was no significant difference when adjusted for total protein. These findings suggest that salivary inflammatory cytokines at rest reflect the inflammatory conditions depending on the menstrual cycle, but did not change in response to acute exercise at VT level.



[9-17]

**Utility of three-dimensional photonic image scanning technique  
for estimating body density in adults and children**

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The body density is an extensively used index of body composition. The purpose of this study was to examine the utility of the three-dimensional photonic image scanning (3DPS) for estimating the body density through comparison with Dual-energy x-ray absorptiometry data as a reference. The body volume was determined with 3DPS for 52 females (18~48 yr) and 16 girls (11~15 yr). The body volume was then corrected for the residual lung volume that was determined by the rebreathing method, the body density was

calculated by dividing the body mass by the corrected body volume. The standard errors of estimation of body density with 3DPS were 0.014 kg/L for adults and 0.017 kg/L for children, which were beyond the allowable limits of body density (0.010 kg/L; Heyward & Stolarczyk, 1996) both for adults and children. These results decline the use of 3DPS for estimating body density of adult females and girls, and call for a need to implement procedures to improve the accuracy of body volume measurement with 3DPS.

[9-18]

**Effects of lower body positive-pressure exercise  
on the lower extremity activities and foot pressure during Running**

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The purpose of this study was to investigate lower extremity activities and foot pressure and contact area during running by using LBPP (lower body positive-pressure), and examine usefulness to rehabilitation. Eight healthy young male volunteers with no orthopaedic participated in this study. We used a device called the Alter-G (Alter G, Inc.). Each subject ran for 4 trials at running speed of 12km/h and 16km/h under two body weight conditions (normal weight and 85% of body weight). We measured EMG activities during running by using portable surface EMG system. We also recorded foot pressure by using F-SCAN and calculated the contact area of

forefoot and heel at the maximum foot pressure during running. The gluteus maximus activity of swing phase at 12km/h and stance phase at 16km/h under 85% of body weight was significantly less than under normal weight. The forefoot pressure at two running speeds was the similar pressure under two weight conditions, but the heel pressure under 85% body weight was lower than normal weight. In conclusion, we suggested that LBPP exercise may have also effective in acquiring range of motion of knee joint and LBPP may help rehabilitation as a means of early recovery, such as ACL reconstruction, other knee injuries and surgery.

[9-19]

**Effects of high-intensity exercise on epidermal barrier function**

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In the previous study, we suggested that high-intensity endurance exercise might depress skin immune function. The aim of this study was to determine the effects of high-intensity endurance exercise on epidermal barrier function, especially moisture content of the stratum corneum and human  $\beta$ -defensin 2 (HBD-2). Six 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.). Moisture content of the stratum corneum was measured by pressed moisture checker (MY-808S, SCALAR) against the skin surface on middle of chest. Skin surface samples were collected at 18:30 p.m. (pre),

19:30 p.m. (post), 20:30 p.m. (60 min), and 21:30 p.m. (120 min). HBD-2 was obtained from 1 ml extraction liquids stirred with the microtube homogenizer in the polypropylene tube for 60 sec on middle of chest. Moisture content of the stratum corneum was significantly lower at pre, 60 min, and 120 min than that at post ( $p < 0.05$ ), and decreased at 120 min compared to that at pre ( $p < 0.05$ ). HBD-2 concentration was significantly higher at post and 120 min than that at pre ( $p < 0.05$ ). These results suggest that high-intensity endurance exercise might depress a physical barrier function and enhance a biochemical barrier function on skin surface.

## [10. Sport Nutrition]

### [10-1]

#### **Type and intensity of physical activity in female athletes determined by accelerometer**

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Since adequate energy intake according to their energy expenditure is important for athletes to enhance their physical performance, estimating energy expenditure is needed. Although examples of time spent in several types of physical activity (PA) according to different physical activity level (PAL) groups were described in the Dietary Reference Intakes for Japanese, it have not been considered for athletes. Additionally, the components of PA (e.g. duration, intensity, type) for athletes have been unclear. The purpose of this study is to explain the PAL and the components of PA for athletes by accelerometer.

9 rhythmic gymnasts (RG) and 9 lacrosse players (LP) participated in this study. Participants were asked to wear the accelerometer and write the times at which the

accelerometer was put on and removed on an activity diary. PA intensities were assessed with the accelerometer data. Time spent in several types of PA (training, sleep, and other PA (lifestyle PA)) were assessed by the accelerometer data and an activity diary.

Significant differences in the duration of training (RG: 327.6±96.3min/day, LP: 175.1±14.0min/day) and lifestyle PA (RG: 568.0±155.3min/day, LP: 772.6±59.5min/day) were observed. The duration of moderate PA was significantly longer among RG compared with LP, whereas the duration of light and vigorous PA were significantly longer among LP compared with RG. Despite the components of PA differed between RG and LP, there was no significant difference in PAL.

[10-2]

**Effects of 12-weeks walking program and vitamin E supplementation  
on oxidative stress markers in older adults**

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The purpose of this study was to investigate the effects of 12-weeks walking program and vitamin E supplementation on oxidative stress markers in older adults. Thirty-eight older adults (60 - 81 yr) were assigned to one of four groups: control (C), vitamin E (S), exercise (Ex), or vitamin E and exercise (S + Ex). The S and S + Ex groups were instructed to take vitamin E capsule ( $\alpha$ -tocopherol, 300 mg/day) for 12 weeks. Exercise program of Ex and S + Ex groups consisted of walking 30-60 min/session on 2 days of the week for 12 weeks. Blood samples were taken at baseline and immediately after 12 weeks. Plasma reactive oxygen metabolites

concentrations were significantly decreased in the Ex and S + Ex group after 12 weeks compared with the baseline values (2-factor ANOVA, group $\times$ time interaction,  $P = 0.001$ ). Conversely, plasma biological antioxidant potential concentrations were significantly increased in the S and Ex group after 12 weeks compared with the baseline values (paired t-tests, S;  $P = 0.001$ , Ex;  $P = 0.002$ ). The results of this study suggest that 12 weeks of walking program and vitamin E supplementation may attenuate resting oxidative stress and increase protection against oxidative stress by increasing antioxidant capacity in older adults.

[10-3]

**Intentional body weight gain and its relationship with insulin resistance  
in young male athletes**

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Excessive weight gain trial by overfeeding may cause an increase in fat mass, such as visceral fat mass, and which possibly increases lifestyle-related disease risks even in young athletes. Therefore, the purpose of this study was to assess the influence of intentional body weight gain on insulin resistance in young male athletes. Methods: In this longitudinal study, eighteen 1st year American football players were followed for one year of weight gain trial. Visceral fat (VF) cross-sectional area was analyzed by MRI technique. Insulin resistance was assessed using the homeostasis model assessment for insulin resistance (HOMA-IR).

Results: After one year of overfeeding, the average changes in BW and FM were  $9.8 \pm 4.2$  kg and  $4.8 \pm 2.3$  kg, respectively. The mean values for VF was significantly increased from  $33.1 \pm 11.4$  cm<sup>2</sup> to  $70.5 \pm 28$  cm<sup>2</sup> (117 % increase). Even though, there was a significant relationship between VF and HOMA-IR, there was no correlation between VF with HOMA-IR. AT the same time, there was no significant change in HOMA-IR (Pre:  $1.1 \pm 0.5$ , Post:  $1.4 \pm 0.8$ ). Conclusion: Although significant increase in VF was observed after one year of intentional weight gain trial, insulin resistance did not change in young male athletes.

[10-4]

**Anti-osteoporotic effect of isoflavone intake on bone mineral density  
in female rat model**

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The purpose of this study was to investigate whether isoflavone intake can prevent bone loss in this female rat model. In this study, we used the female rat model which we had attempted to establish animal model of osteoporosis for female athlete previously. Thirty-five female Sprague-Dawley rats (8 wk old) were randomly divided to two groups, running group or sedentary group. Running group were free access to wheels throughout the study. At 18 wk of age, the rats in each group were randomized into three groups as follows: 1) RC group, 2) RR

group, 3) RR+Iso group, 4) SC group, 5) SR group, 6) SR+Iso group. Group 1), 4) were no limit of food intake. Group 2), 5) were 30 % dietary restricted. Group 3), 6) were 30% dietary restricted and the diet containing 0.5 % isoflavone powder. After intervention period, the BMD of proximal region of the femur in the RR group was significantly lower than RC group, but no difference was observed between RC group and RR+Iso group. Present study suggested that isoflavone intake inhibited bone loss in female athlete rat model.

## [11. Biomechanics]

### [11-1]

#### **Relationship between the ball spin and the flight trajectory in various kinds of baseball pitch**

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We succeeded in estimating the displacement of the flight trajectory of baseball fastball from ball speed, the direction of spin axis, and the ball spin rate (the 5th symposium on “Active life”). In this study, we investigated various kinds of pitch including fastball.

Seven collegiate pitchers threw 2 to 5 kinds of their own pitches for 3 throws each (66 pitches in total). Four high-speed video cameras were used to record the position and the orientation of the pitched ball. The three-dimensional coordinates of the trajectory of the ball were obtained with the DLT algorithm. In addition, we defined  $\Delta Z$  and  $\Delta X$  for each pitch, as the amount

of displacement from the free fall trajectory. The orientation of ball spin axis and spin rate were obtained using a custom-made apparatus. We decomposed the spin parameter, the ratio of ball speed and spin rate, to vertical component ( $Sp_{ver}$ ) and horizontal component ( $Sp_{hor}$ ) of the ball coordinate system.

The  $\Delta Z$  was positively correlated with the  $Sp_{ver}$  ( $R^2 = 0.864$ ,  $p < 0.001$ ), and the  $\Delta X$  was negatively correlated with the  $Sp_{hor}$  ( $R^2 = 0.884$ ,  $p < 0.001$ ). These results suggest that the amount of displacement of the various kinds of pitch could be predicted from the spin rate, the direction of spin axis, and the ball speed.



[11-2]

**Abdominal breathing technique reduces the leg-sinking effect of buoyancy  
in a streamlined position of swimming**

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The purpose of this study was to examine if the leg-sinking effect of buoyancy around the center of mass (CM) could be reduced by altering breathing technique. Ten healthy men who practiced the two breathing techniques - chest breathing and abdominal breathing, participated in this study. The positions of the CM and center of buoyancy (CB), the distance between them (CB-CM distance), and leg-sinking effect of buoyancy were determined as time-series data during inhalation with each breathing technique. The result showed that the CB-CM distance increase by 1.21( $\pm$ 0.26) cm during inhalation with chest breathing mainly due to the cranially-directed translation of CB.

On the other hand, the CB-CM distance increased by 1.11( $\pm$ 0.28) cm with abdominal breathing mainly due to caudally-directed translation of CM. As a result, the escalation of leg-sinking effect was significantly smaller ( $p < 0.01$ ) with abdominal breathing (7.88Nm) than with chest breathing (8.56Nm). The present results clearly indicate that the leg-sinking effect of buoyancy can be reduced by altering breathing technique. Reportedly, the leg-sinking effect of buoyancy correlates positively with the energy cost of swimming. Hence, our results suggest that swimming with abdominal breathing should reduce the energy cost of swimming and improve the performance of swimming.

[11-3]

**Growth-induced increase of the Achilles tendon moment arm does not parallel growth of the body height**

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The purpose of this study was to compare the growth pattern of the Achilles tendon moment arm and that of body height. Three lower grades of elementary school students (LE), 3 upper grades of elementary school students (UE), 11 junior high school students (JH) and thirteen adults (AD) participated in this study. A magnetic resonance imaging system was used to record a series of coronal images of the right ankle at 10° dorsiflexion, anatomical position, 10° plantarflexion. The talocrural joint axis was calculated by changing the position and orientation of the talus relative to the fixed tibia

from 10° dorsiflexion to 10° plantarflexion. The Achilles tendon moment arm was determined as the shortest distance between the talocrural joint axis and the line of action of the Achilles tendon force. LE, UE, JH and AD groups had 28 mm, 30 mm, 31 mm and 41 mm of the Achilles tendon MA, respectively. LE, UE, JH and AD groups had 1.21 m, 1.45 m, 1.66 m and 1.71 m of body height, respectively. The current result suggested that the Achilles tendon moment arm increases at a faster rate from junior high school to adults unlike the body height that increases evenly with growth in each stage.

[11-4]

**Characteristics of swimming form on open water swimming**

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Open water swimming (OWS) is a swimming event at ocean. The course of OWS is not divided by course rope. Thus, the athletes have to check buoys while swimming. However, no study has focused on this motion. The purpose of this study was to determine the characteristics of two OWS strokes (pool and ocean) and how these strokes change during the season by three-dimensional methods. Nine OWS athletes performed both pool and ocean strokes, and nine competitive swimmers performed only pool stroke. Stroke rate, stroke length, duration of stroke phase, hand displacement, hand velocity, and hand angle were measured during each stroke motion. On pool stroke, OWS athletes and competitive swimmers had relatively similar

characteristics of hand displacement and angle. On ocean stroke, OWS athletes had significantly longer stretch phase, more shallow sweep, smaller hand angle at the bottom of stroke than OWS pool stroke ( $p < 0.05$ ). In the stretch phase of ocean stroke, hands were swept up and then moved downward on almost of all OWS athletes. Finally, there were no significant seasonal change in stroke expect hand angle at the bottom of stroke. These findings indicate that OWS athletes spend longer stretch phase to check buoys on ocean stroke, which could result in their distinctive swimming motion. Two kinds of OWS strokes did not seem to be influenced by practical settings in a season.

[11-5]

**Contributions of inside and outside legs to the change in traveling direction of the center of mass during running on a circular path**

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The purpose of this study was to determine the contributions of inside and outside legs to the change in traveling direction of center of mass during running on a circular path. Six healthy male subjects participated in this study. Each subject performed running at the speed of  $5 \pm 0.5$  m/s on a circular path with 5m radius. The running direction was counterclockwise as viewed from above. For each trial, subject was asked to step onto two force platforms embedded along the runway in two consecutive contact phases. A motion capture system operating at 240Hz was used to record the whole body motion as the runner passed over the force platforms.

The position of the runner's center of mass was determined by using body segment inertial parameters reported by Ae et al. (1992), and its time-derivatives were computed. Step angle was defined as the angular displacement of the horizontal velocity vector that took place within each contact phase. Bilateral difference was not found in step angle (inside:  $15.5^\circ$ , outside:  $16.0^\circ$ ) or in step length (inside: 1.40m, outside: 1.38m). The present study demonstrated that both inside and outside legs contributed equally to the change in traveling direction of center of mass during running on a circular path.

[11-6]

**Knee Biomechanics during Side-step Maneuvers in Anticipated and Unanticipated conditions**

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The aim of this study was to investigate whether the unanticipated situation would be more risky compare to anticipated situation during side-step tasks. Nine healthy male athletes performed three maneuvers after standing broad jump ; side-steps for 45 (S45) and 90 degrees (S90), and crossover-step for 45 degrees (C45), under two different conditions; anticipated and unanticipated. Using three LED signals, subjects were given cues for 1 of the 3 maneuvers in both the anticipated (AN) and unanticipated conditions (UN). Subjects received the cue before the trial, during AN. During UN, subjects received visual cue after jumping and before reaching step position. Three dimensional

motion analysis system and force plate were used to measure knee kinetics and kinematics. For this study, only S45 and S90 were analyzed.

During S45 maneuvers, external knee abduction moment in UN until 40msec after foot contact was higher than in AN significantly ( $p<0.05$ ). During S90, external knee internal rotation moment in UN until 40msec after foot contact was higher than in AN significantly ( $p<0.05$ ).

Knee abduction and internal rotation moment are risk factor for knee ligament injury. The results of this study indicated that unanticipated step tasks are important to identify the knee ligament injury risk.

[11-7]

**Lower extremity joint kinematics and kinetics during a drop jump task with and without a lacrosse stick**

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Majority of anterior cruciate ligament (ACL) injuries in female athletes have been reported to occur while landing from a jump and cutting. Women's lacrosse has a higher incidence rate of ACL injuries than other competitive sports. The purpose of this study was to examine lower extremity joint kinematics and kinetics during a drop jump task carried out with and without a lacrosse stick. Nine female collegiate lacrosse players (mean age,  $20.0 \pm 1.3$  years; height,  $159.6 \pm 5.8$  cm; weight,  $55.1 \pm 6.3$  kg; lacrosse experience,  $24 \pm 3.4$  months) participated in this study. An eight-camera motion analysis system and a force plate were used to record three-dimensional marker positions and ground reaction forces. Drop jump tasks were performed

while not holding a lacrosse stick (NH), holding a lacrosse stick in the right hand (RH), and holding a lacrosse stick in the right hand with a target ball (RHT). The peak knee flexion angle in RHT was significantly smaller than that in RH ( $109.7 \pm 10.4^\circ$  vs.  $113.5 \pm 9.8^\circ$ ,  $p < 0.05$ ). Knee extension position during landing maneuver has been reported to be associated with risk factors for ACL injuries. The results suggested that RHT tended to involve a smaller knee flexion angle during landing than RH. Therefore, the drop jump task with holding a lacrosse stick with set a target (e.g. lacrosse ball) may be used as a screening test to prevent lower extremity injuries, such as ACL injuries, in female lacrosse athletes.

[11-8]

**Contributions of ankle and hip joint kinematics to knee abduction during running**

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The knee is the most common site of running injuries. A large knee abduction angle has been reported as a kinematic risk factor of running injury at the knee. The purpose of this study was to clarify the contributions of ankle and hip joint kinematics to the peak knee abduction angle during running. Seventy runners (54 males and 16 females) participated in this study. Each subject ran along a 25m runway at a speed of 4 m/s. Three-dimensional reflective marker positions and ground reaction forces were simultaneously recorded with a motion analysis system and a force plate. The stepwise multiple regression analysis revealed that the peak knee

abduction angle could be predicted by the hip internal rotation, rearfoot eversion, hip adduction angles at the instant at which the peak knee abduction angle observed (adjusted  $r^2 = 0.842$ ) in the order of strength of standardized partial correlation coefficients. In addition, 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 ( $r = -0.724$ ,  $p < 0.001$ ). These results suggest that the rearfoot and hip kinematics are likely to influence the kinematic risk factor of running injury at the knee.

[11-9]

**Quantitative approach for evaluating sports performance using a model-based image-matching technique: A case report of football game situations**

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Defensive actions are considered to be of major importance for success in football games, yet the biomechanical aspects of defensive actions remain unknown. The main purpose of this case study was to evaluate the feasibility of a Model-based Image-matching (MBIM) technique to quantitatively analyse one-on-one defensive movement in real football game situations. Two of the 4 defenders studied performed side-step manoeuvres (side-1, -2) whereas the other 2 used crossover-step manoeuvres (crossover-1, -2). Side-1 and crossover-1 were considered successful because the players were able to stop the attacker during

the dribble. On the other hand, the side-2 and crossover-2 cases were considered unsuccessful because the players were not able to stop the dribble attack. Model-matching was successful in all situations and revealed that compared with the unsuccessful defenders, the 2 successful defenders performed cutting manoeuvres with shorter ground contact time, smaller centre of mass displacement, and lesser knee, hip and trunk flexion. It therefore seems feasible to use this technique in further studies with a larger number of players to study defensive performance in football.



[11-10]

**A method for measuring complete range of three-dimensional shoulder motion**

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The purpose of this study was to develop a method for measuring the entire range of shoulder motion. A subject was instructed to move his right arm in a circular pattern while maintaining his arm in maximum internal rotation. The circular movements were performed on many different planes repeatedly so that he could exhibit full range of shoulder joint motion. An electromagnetic goniometer system was used to measure horizontal abduction, elevation and internal rotation angles. The determined series of internal rotation angles were expressed as a function of the horizontal abduction and elevation angles to define the boundary of maximum internal rotation angles

for given combinations of horizontal abduction and elevation angles. The same procedure was repeated for maximum external rotation, so that the determined two boundaries could “envelope” the entire range of shoulder motion permissible to the given shoulder. The test-retest reliability of the boundaries was found high (ICC=0.705 for internal & 0.935 for external rotations). With internal/external rotation angles measured statically at selected shoulder positions as reference, the validity of the procedure was tested. The RMS error was 19.1 degrees. Further improvement is necessary to reduce the measurement error.

[11-11]

**How to hit opposite-field hitting in baseball:  
Relations between the impact condition and the initial velocity of batted ball**

Shuji Kidokoro<sup>1</sup>, Yoshitaka Morishita<sup>1</sup>, Shoji Konda<sup>2</sup>, Taku Wakahara<sup>2</sup>, Toshimasa Yanai<sup>2</sup>

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The purpose of this study was to examine the kinematic parameters of ball impact that determine the direction of the initial velocity of the batted ball in opposite-field hitting. Sixteen collegiate baseball players performed ten trials of opposite-field hitting with maximal effort. Behavior of the ball impact was recorded with three high-speed cameras (1000 fps) and the DLT algorithm was used to reconstruct three-dimensional motions of ball and bat. The projection angles of the bat on the horizontal plane (horizontal angle) and the vertical plane (vertical angle) were determined at the ball impact. A positive horizontal angle indicates the head being closer to the catcher than the grip and positive vertical angle indicates the head being closer to the ground. The horizontal component of the initial velocity of the batted ball was directed to the opposite field by  $23.0 \pm 7.5^\circ$  from

the center line of the field. At the ball impact, the horizontal bat angle was  $7.3 \pm 7.4^\circ$ , suggesting that the angle of reflection (approx.  $15.7^\circ$ ) was slightly too large for the given the angle of incidence (approx.  $7.3^\circ$ ) and the coefficient of restitution. The vertical bat angle was  $27.9 \pm 6.0^\circ$ . With this vertical angle, the batted ball could travel more towards the opposite field if the ball was hit by the upper surface of the bat. These results suggest that the collegiate baseball players do not only adjust the bat angle on the horizontal plane to perform the opposite-field hitting, but they also applied a strategy of adjusting two additional factors – the vertical bat angle and the position of the ball impact relative to the center line of the bat – to direct the batted ball farther towards the opposite field.

[11-12]

**Contributions of torso and upper extremity rotations  
for producing bat-head velocity in baseball batting**

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The purposes of this study were to investigate the contribution of the torso and upper extremity rotation for producing the bat-head velocity in baseball batting and to identify the factors influencing the between-subject variance in bat-head velocity. Seventeen male collegiate baseball players were asked to perform ten trials of tee-batting. A motion capture system operating at 500 Hz was used to determine 3-D coordinates of markers attached onto selected body landmarks. A simplified mechanical model composed of five rigid segments (pelvis, thorax, shoulder girdle, upper extremity and bat) interconnected by joints was developed to calculate the contribution of each segment to the bat-head velocity. The contribution of each segment was calculated as the ratio of the hypothetical bat-head velocity that could be

obtained thoroughly by the rotation of the segment, to the observed bat-head velocity. At the ball impact, the mean values for the contributions of bat rotation relative to the upper extremity and of the rotation of the torso were 76% and 33%, respectively. Additionally, the contributions of bat rotation relative to the upper extremity and of the pelvis were correlated with the bat-head velocity at the ball impact ( $r = 0.57$ ,  $p < 0.05$  &  $r = -0.55$ ,  $p < 0.05$ , respectively). These results indicate that the bat-head velocity at ball impact was determined almost entirely by the rotations of the pelvis and of the bat relative to the arms, and that a fast head velocity was attained by those who reduced the contribution of the pelvis and maximized the bat velocity relative to the arms by the time of impact.

[11-13]

**Three-dimensional torso movement during front crawl swimming**

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Low back pain is a common problem among competitive swimmers and excessive torso motion is claimed to be an etiological factor. The purpose of this study was to test a hypothesis that swimmers experience hyper-extension of torso during front-crawl swimming. Six members of collegiate swimming club underwent two data-collection sessions: a dry-land measurement of active range of torso extension and a front-crawl trial in a swimming pool. A simplified kinematic model composed of scapulae, thorax and pelvis was used to describe the torso configuration and an electromagnetic tracking device was used to record the movements of the four segments. The

measurement error was found to be  $< 5^\circ$ . The average value for the maximum extension was  $48 \pm 13^\circ$  in dry-land measurement and  $23 \pm 12^\circ$  during front-crawl. No subject used torso configurations that exceeded the active range and the hypothesis was rejected. Within 0.2 seconds around the instant at which the maximum extension was attained, the torso was laterally tilted by  $36 \pm 9^\circ$  and rotated by  $56 \pm 14^\circ$ . The results suggest that low back pain among swimmers might be due to the complex three-dimensional torso motions repeated many times during front-crawl, rather than excessive planer motions.

[11-14]

**Hamstring Muscle Kinematics during the acceleration phase of spring**

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The purpose of this study was to investigate hamstring muscle kinematics during the acceleration phase of sprinting, and compare it with the maximum speed phase. Eight male track and field athletes (age,  $18.6 \pm 7.9$  years) performed maximal sprint from 2 starting lines, set approximately 15 and 60 m from the center of the measurement area. A three-dimensional musculoskeletal model was used to compute muscle lengths and muscle-tendon forces of the biceps femoris (BF), semitendinosus (ST), and semimembranosus (SM) muscles during the sprinting gait cycle. Hip flexion, knee flexion, and pelvic anterior tilt angles were also calculated. Hip flexion, knee flexion, and the

pelvic anterior tilt angles were significantly greater during the acceleration phase than during the maximum speed phase. Hamstring muscle lengths peaked during the terminal swing of the gait cycle, and at foot strike, they were significantly greater during the acceleration phase than during the maximum speed phase (BF,  $p < 0.01$ ; ST and SM,  $p < 0.001$ ). The hamstring muscle-tendon forces showed no significant difference between the 2 phases. The results of this study showed that compared to the maximum speed phase of sprinting, sprinters tend to have more forward trunk lean during the acceleration phase, and this may cause stretching of the hamstring muscles at foot strike.

[11-15]

**The analysis of accuracy in the services of various sports**

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In services of many sports players are required not only that they could hit a target as close as possible but also precision that could do it over again. The purpose of this study is to verify the accuracy in the services of various sports with special attention to the error and fluctuation of the point where the services got the floor for target.

The subjects who participated in the experiment were all collegiate top level sports players, consisting of 8 volleyball players (years of experience:  $10.5 \pm 2.1$  years), 6 badminton players ( $10.2 \pm 2.7$ ), 7 tennis players ( $12.7 \pm 2.7$ ) and 8 soft tennis players ( $10.0 \pm 2.7$ ). The players performed 4 sets of 5 consecutive services aiming at targets in three conditions; (1) Side,

(2) Center, and (3) Game. In Side and Center conditions subjects served to aim for the each target with easy services way to aim for target and in Game condition aim for the target with the services way of actual game. The accuracy in the services was evaluated by using the average distance between the target and the point where the served ball hit the floor and its standard deviation. In addition, to compare among four different sports, normalized error (%) was obtained by dividing the distance with the length between the target and the service position.

The result showed that there existed normalized error of 5-10% and standard deviation of about 3%.

[11-16]

**Regional differences in fascicle length, fiber length and series sarcomere number of human medial gastrocnemius muscle: a cadaveric study**

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Architecture of a skeletal muscle has considerable effects on muscle force and power generation. Available data on the architectural parameters suggest existence of intramuscular differences but the results are controversial. The purpose of this study was to investigate regional differences in fascicle length, fiber length and series sarcomere number of human medial gastrocnemius (MG). Fibers were isolated from fascicles removed from nine sites (proximal, central and distal sites of medial, midsagittal and lateral regions) of an embalmed cadaveric muscle of MG (82 years, 153.2cm, 59.6 kg). The fascicle length was measured by caliper. The fiber length was determined by tracing the scanned image. In each fiber, sarcomere lengths were calculated at five different positions by

taking the inverse of the centroid frequency of the first-order peak obtained from microscopic image of the fiber by using the fast Fourier transformation. The series sarcomere number was calculated from the fiber length divided by the average sarcomere length. Each parameter showed a tendency to increase from proximal to distal, and medial to lateral directions while the sarcomere number at a given fiber length did not show substantial variation among the sites. These results suggest that there are intramuscular differences in architectural parameters of human medial gastrocnemius muscle, and that the regional differences of fascicle and fiber lengths are attributable to those of series sarcomere numbers within fibers.

[12. Coaching]

[12-1]

**Effects of practicing V2 skating with a flight phase  
on the skating velocity of female cross-country skiers**

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This study attempts to clarify how the guidance and training of V2 skating that intentionally includes a flight phase affects the skating velocity of female cross-country skiers. The test subjects were five female skiers who did not have any flight phase in their regular V2 skating practice. In the experiment, the test subjects were first asked to perform a practice jump without a flight phase after a 20 m skate and their velocity was recorded. They were trained to glide with flight phases for about 10 minutes and then asked to do a practice jump with flight phases. In the test, the subjects used poles and skies equipped with force sensors to measure the forces of the poles and skies. After the test, each skier was interviewed about how she felt skating under those circumstances. The

result of experiment showed that the training caused all skiers to change their skating style to V2 skating with flight phases. Moreover, in the skating attempts with flight phases, the skating velocity and the peak and average forces of the pole and ski significantly increased. The interviews revealed that three subjects felt a sense of fear as they were airborne and that four subjects felt a near loss of balance. These results suggest that practicing skating with flight phases was effective in increasing the skating velocity of the female skiers. Moreover, it was difficult for the female skiers to learn to skate with flight phases through a normal training method because of the sense of fear that they experienced during the maneuver.



[13. Health and Welfare]

[13-1]

**An increase in daily activity modulates neural response of the hypothalamus during heat load and behavioral thermoregulation in mice**

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To know the mechanism that daily activity enhances behavioral thermoregulatory response, neural activity in the hypothalamus, the center of thermoregulation, was evaluated in such conditions. Male ICR mice were divided into two groups: one had running wheel in a cage for 8 wk (WR, n=40) and the other did not (NWR, n=40). After the 8-wk with or without the running wheel, mice had three different protocols: 90-min exposure at 39°C, an operant thermoregulatory-behavior setting (20 -cold reward during 90-min 39°C exposure), or a thermal mosaic setting (evaluating thermal preference among 15°C, 22°C, 28°C, 35°C and 39°C environments) in a new system we recently developed (a box with 5 Pertier bottom-boards, of which temperature was controlled by

computer program). After killing the mice, we counted cFos-immunoreactive (IR) cells in the hypothalamus of the brain. After the exposure at 39°C, counts of cFos-IR cells were greater in the WR group than in the NWR group in the preoptic area (PO) in the hypothalamus. After the operant behavior, counts of cFos-IR cell were not different between the two groups. In the thermal mosaic setting, the counts were greater in the WR group than in the NWR group. Daily activity modulates neural activity in the hypothalamus during autonomic and behavioral thermoregulation. In addition, this modulation may be involved in behavioral thermoregulation in exercising animals and humans, which we previously observed.

[13-2]

**Correlates of physical activity among overweight and obese populations:  
a review of the literature**

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The dose-response association between physical activity (PA) and obesity is well-established however the correlates of PA among overweight and obese populations require clarification. Therefore, the purpose of this study was to review the correlates of PA among overweight and obese populations. Literature searches were conducted for English-and Japanese-language published articles between Jan 2000 and Dec 2010 using “PubMed”, “Medline”, “Psycinfo” and the “Japan Medical Abstract Society”. A total of nine eligible articles were included in the analysis: five studies compared the PA correlates between normal-weight and overweight/obese

populations; four studies examined PA correlates in overweight/obese populations. Consistent correlates of PA among overweight and obese populations were age, self-efficacy, social support, perceived good access to facilities and seeing people being active in the neighborhood. For obesity prevention, particularly in non-Western countries, further research is required with the purpose of developing effective PA interventions among overweight and obese populations. Future studies should examine both perceived and objectively-assessed environmental factors associated with specific PA behavior.

[13-3]

**Participation in Social Activity and Quality of Life among Elderly: A review**

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With the rapid growth of the elderly population, in order to live a longer and prosperous life, it is very important to keep healthy life for the old people. Social participation is an important modifiable health determinants and a key outcome measure for health. However, the definitions of social participation are diverse and which is currently undefined. Also little is known about relationship between social participation and quality of life (QOL). The present review study retrieved papers published in last 20 years from January 1991 to December 2011 for examining the relationship between social participation and

QOL. Four databases (CINII, Japan Medical Abstracts Society and PUBMED, Google scholar) were searched with keywords (Aging OR Elderly OR Older OR Seniors AND Social activity/ participation /involvement AND Quality of life). Finally, fourteen papers were found. Participation in social activity was closely related to QOL in social activities. However, majority of previous studies focused on healthy people and examined with small sample. A growing number of elderly decreased functional independence. Therefore further researches including frail elderly as participation are needed.

[13-4]

**Electroacupuncture restored skeletal muscle atrophy induced  
by a novel spiral wire immobilization procedure**

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Disuse from immobilization due to casts applied during surgeries induces skeletal muscle atrophy, during which various events occur; however, the underlying molecular mechanisms have not yet been fully elucidated. In addition, no convenient and reasonable rodent model of muscle disuse atrophy is available. In this study, we invented a new immobilization procedure that involved plantar flexion of the foot joint covered with spiral iron wire (SWI) to evaluate the preventative effect of electroacupuncture on skeletal muscle atrophy. After 2 weeks of SWI-induced immobilization, muscle wet weight decreased significantly in the soleus (54%,  $p < 0.001$ ) and plantaris (71%,  $p < 0.001$ ). However, this decrease induced by SWI was significantly

increased by manual acupuncture (MA; 67%,  $p < 0.01$ ) and electroacupuncture (EA; 75%,  $p < 0.001$ ). The representative muscle-specific atrophic gene, muscle atrophy F-box (atrogin-1/MAFbx) was significantly increased in the soleus (199%,  $p < 0.01$ ), however, this gene expression induced by SWI was significantly decreased by EA (132%,  $p < 0.05$ ). We conclude that this novel SWI-induced immobilization procedure is useful, furthermore, no use any surgery and expensive devices. In accordance with our previous hindlimb suspension study, we show that acupuncture treatment is efficient for preventing immobilization-induced skeletal muscle atrophy.

[13-5]

**The influence of a physical exercise during hemodialysis in improving body function**

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**Introduction:** Patients on hemodialysis (HD) experience various conditions, including physical depression, muscular atrophy, decrease in balance and flexibility. Studies have demonstrated a high mortality rate among dialyzed patients who do not exercise. Therefore, in this study, we evaluated the effect of exercise training during dialysis for one year on the physical function of patients.

**Methods:** Participants were 12 dialysis patients (mean age,  $66.4 \pm 7.63$  years). First, we evaluated patients' physical function. Intervention was then initiated, and involved physical exercise of the trunk and lower limbs in bed once a week during dialysis for 1 year. After 1 year of intervention, we again measured physical function and administered the questionnaire in order to assess any differences before and after the intervention. Before and after were compared

using a Wilcoxon signed-rank test with SPSS for Windows (ver. 15).

**Results:** There were significant differences in hand grip strength, knee and hip muscle strength power, one-leg standing time with eyes closed, FR, TUG, and 10 m walking speed before and after the intervention ( $P < 0.05$ ).

**Conclusion:** This study showed that exercise therapy during dialysis for one year motivated all patients to safely continue exercise programs without dropping out. Furthermore, significant improvements in physical function were observed after the one-year intervention. In the future, we need to develop exercise programs based on disease management and develop an approach that encourages exercise as a continuous habit.

[13-6]

**The health-related quality of life and associated with utilization  
among the senior centers in Korea**

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The overall purpose of our research was to develop studies on the senior center and clarify the health-related quality of life (HRQOL), psychological, social, and environmental factors associated with the utilization of the senior center in Korea. Here we report two findings from our ongoing studies. First, we have examined the relationship between the use of senior center and HRQOL in older adults (Study 1). The 8-domain scales of physical function and role function were significantly higher in the users of the senior center compared with the non-users ( $F=4.87$ ,  $P=0.027$  and  $F=7.02$ ,  $P=0.009$ , respectively). Vitality was also significantly higher in the users of the senior center compared with the non-users ( $F=7.48$ ,  $P=0.007$ ). Second, we have investigated the relationships between the psychological, social

and environmental factors influencing the use of senior centers among older adults (Study 2). Our results have shown that the use of senior centers in Korea was affected by the higher self-efficacy ( $OR=6.08$ ;  $95\%CI: 3.31-12.32$ ), higher family support ( $OR=4.21$ ;  $95\%CI: 2.02-8.77$ ) and higher friend support ( $OR=4.08$ ;  $95\%CI: 2.38-7.81$ ). The results also showed that the total travel time was between 15-29 minutes ( $OR=2.84$ ;  $95\%CI: 1.21-3.64$ ) and less than 14 minutes ( $OR=4.68$ ;  $95\%CI: 3.41-8.41$ ) were more likely to use the senior center compared with those of more than 30 minutes. Our findings demonstrate that the use of senior centers in Korea is affected by the HRQOL, self-efficacy, perceived benefit, perceived barriers, social support, conveniences of transportation and total travel time to the senior centers.

[13-7]

**Association of eHealth literacy with health status and behavior among Japanese adults**

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In rapidly developing Internet-user societies, eHealth literacy has become important to promote eHealth and aid health care. Although previous studies have observed that limited health literacy is associated with poor health status and behavior, little is known whether eHealth literacy is associated these outcomes. The present study examined associations between eHealth literacy, health status and health practices among Japanese adults. Participants were recruited (in January, 2012) from registrants of a Japanese Internet research service company and asked to answer a cross-sectional Internet-based survey. The set sample size and attributes in the present study were as follows: 2,000 men and women aged 20–59 years with equivalent numbers of men and

women in each age bracket. The research company provided data on sex, age, marital status, educational attainment, household income level, and frequency of Internet searching. eHealth literacy was measured by the Japanese version of the eHEALS. Health status was assessed using Medical Outcomes Survey Short Form-8 questionnaire, body mass index, and chronic conditions (e.g. hypertension, diabetes mellitus, heart failure). Obtained Health behaviors included self-reported cigarette smoking, alcohol consumption, sleeping hours, working hours, physical exercise, eating breakfast, balanced nutrition, and health examination practice. Data provided complete information for the study variables will be analyzed.

[13-8]

**Sources of health information related to physical activity and eating behavior among Japanese adults**

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The purpose of this study was to examine the relationship between health information sources (mass-media sources and interpersonal sources) and health behaviors (physical activity and eating behavior) among Japanese adult. Participants were 898 Japanese male and female adults ( $41.5 \pm 9.8$  years) who had been registered with a social research company. The cross-sectional questionnaire survey was conducted via the Internet in November 2009. The survey included items on health information sources (mass-media sources including TV, radio, newspaper, magazine, Internet; and interpersonal sources including family, friend and coworker, and healthcare worker) as the independent variable, and health behaviors (physical activity and eating behavior) as the dependent variables.

Multivariate logistic regression analysis was used to examine the relationship of health information sources with health behaviors. In multivariate logistic regression analysis adjusted for health information sources, gender, age, and income, health information obtained from their family were positively associated with eating behavior. Participants reporting use of magazine and Internet as sources of health information were significant more likely to meet recommendations for physical activity (23Ex/week). These results suggest that health information from family may be useful for the promotion of healthy eating. Also, health information from magazine and Internet may be useful for promotion of the physical activity.



[13-9]

**Effect of a single bout of aerobic exercise on postprandial glucose metabolism after short-term high-fat diet intake**

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**Objective:** A single bout of aerobic exercise has the potential to improve glucose tolerance for several days. The purpose of this study was to investigate the effects of a single bout of aerobic exercise on postprandial glucose metabolism after 3-day high-fat diet in healthy men.

**Methods:** Eleven healthy men underwent two 3-day period of high-fat diet intake with either no exercise (HFD) or endurance exercise (50% maximal oxygen uptake, 200 kcal; HFDEx) and 3-day normal diet without exercise (ND). Exercise was performed one time at 3 day of dietary intervention. Postprandial glucose metabolism was determined by 75 g oral glucose

tolerance test (OGTT) after 3-day diet intervention.

**Results:** The incremental area under curve (iAUC) of blood glucose concentration during OGTT was significantly higher in HFD and HFDEx than in ND ( $P < 0.05$ ). The iAUC of insulin concentration was not significantly different among three interventions. However, the insulinogenic index was significantly lower in HFD and HFDEx than in ND ( $P < 0.05$ ).

**Conclusion:** These results suggest a single bout of aerobic exercise could not improve glucose tolerance complicated after 3-day high fat diet intake

[13-10]

**Objectively measured neighborhood features of walking among Japanese adults**

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**Background:** Built environment is an important correlate of physical activity promotion. Understanding the long-term effects of environment on health behavior is important for the promotion of population-based physical activity.

**Purpose:** The purpose of the present study was to examine the relationship between objective measures of environment and walking among Japanese adults.

**Methods:** The present study was a population-based cross-sectional study. Three thousand residents aged from 40- 69 years old who lived in Japan were selected. The self-administered questionnaire survey which included questions on sociodemographic status such as gender, age, educational attainment (graduate school or university, 2-years university,

high or junior high school), employment status (office worker, student, housewife, part-time worker, unemployed), marital status (married, unmarried), household income (<3,000,000, <5,000,000, <7,000,000, <10,000,000, ≥10,000,000 yen), and body mass index) and total walking time per day was conducted by mail. Objective environmental variables were assessed using Geographic Information System (GIS). The GIS will be utilized to assess the residential density, access to public transport, length of sidewalk, and access to parks within the 800m radius from each participant's home. Logistic regression analyses are conducted to examine the independent relationships between each environmental variable and walking time. At present, the researchers are gathering data.

[13-11]

**Habitual alcohol intake is an independent predictor of metabolic syndrome risk as well as cardiorespiratory fitness in Japanese adults**

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The purpose of this study was to examine the association of cardiorespiratory fitness (CRF) and habitual alcohol intake with metabolic syndrome (MS) risk in Japanese adults. METHODS: Participants included 110 Japanese men and 117 women aged 20–70 years. Habitual alcohol intake was assessed by a self-administered diet history questionnaire. CRF was assessed by measuring VO<sub>2</sub>max. The number of MS risk factors was calculated from the criteria value of MS. Participants were classified into three alcohol intake status categories (Non-, Moderate-, and Heavy-) and two CRF categories (Low and High). RESULTS: Multiple linear regression analysis revealed that

both VO<sub>2</sub>max and alcohol intake were independently correlated with the number of MS risk factors ( $\beta = -0.26$  and  $0.24$ ,  $p < 0.001$ , respectively) after adjusting for sex, age, smoking status, energy intake, and step-counts. In Non- and Moderate-alcohol intake group, High-CRF group had lower risk of metabolic syndrome than Low-CRF group. But, in the Heavy-alcohol intake group, High-CRF group had the same risk of MS as Low-CRF group. CONCLUSION: These results suggested that both habitual alcohol intake and CRF are independent predictors of MS in Japanese people, and heavy alcohol intake has higher risk of MS even with high CRF.

[13-12]

**Differences of abdominal muscle thickness  
between chronic low back pain patients and healthy subjects**

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**Introduction:** It has been reported that patients with chronic low back pain (CLBP) showed an asymmetry of the lumbar multifidus muscle thickness. We hypothesized that the thickness of transversus abdominis in CLBP patients is decreased similar to the multifidus muscles. In this study, we compared the thickness and asymmetry ratio of the abdominal muscle group between healthy subjects and CLBP patients.

**Methods:** The subjects were 50 patients with CLBP (31.5±8.7 years) and 50 healthy subjects (30.2±6.1 years). Muscle thicknesses of the rectus abdominis, external oblique, internal oblique, and transversus abdominis were measured using ultrasonography. We calculated

the mean thicknesses (MT) of each muscle and the asymmetry rate (AR) which was calculated as a percentage difference between both sides and compared them between two groups using t-test. Significance was recognized at  $p < 0.05$ .

**Results and Discussion:** There was significant differences between CLBP patients (MT: 3.7±0.8 mm / AR: 16.4±12.1 %) and healthy subjects (MT: 4.2±1.2 mm / AR: 8.4±7.5 %) in the transversus abdominis, however, significant differences were not observed in another abdominal muscles. These results suggest that muscle atrophy and an asymmetry of the transversus abdominis might be related to CLBP.

[13-13]

**Strategies for promotion of meeting recommended physical activity  
among Chinese adults**

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To propose the effective strategies for promotion of meeting recommended physical activity level among Chinese adults, the present study investigated the difference between meeting recommended physical activity level and health-related quality of life (HRQOL), and explored the factors related to meeting recommended physical activity level among Chinese adults.

Data were analyzed for 1394 Chinese adults who responded an Internet based cross-sectional survey. Self-reported measures of physical activity (IPAQ-SV), HRQOL (SF-36), psychological, social, environmental, and demographic variables were obtained. Multivariate analyses of covariance and adjusted logistic regression model were utilized.

Those meeting the physical activity recommendation had significantly higher scores on the multiple HRQOL domains than inactive individuals. Moreover, self-efficacy, access to facilities, advice from health professional and living in rural areas were positively associated with meeting the physical activity recommendations.

These results suggest that attaining the recommended level of physical activity may be effective for maintaining or enhancing some dimensions in both the physical and mental aspects of HRQOL. Also an intervention design that accounts for those correlates may more effectively promote physical activity among Chinese adults.