PROGRAM & ABSTRACTS

Inaugural International Academy of Sportology

Date: March 5, 2011
Venue: ARIYAMA NOBORU Memorial Hall, Juntendo University
President: OGAWA Hideoki (CEO, Juntendo University)

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WELCOME MESSAGE

Dear our colleagues:

On behalf of the Organizing Committee of the International Academy of Sportology, I am pleased to announce you that the Inaugural Congress after the 3 fruitful pre-congresses is finally held on 5th March, 2011 in Tokyo, Japan.

What is "Sportology"?
In order to find the answer to this question, we had 3 pre-congresses beforehand. "Sportology" involves a lot of studies, such as philosophy and sociology as well as preventative medicine, health science, psychology and sports medicine for competitive sports to clarify the relation between sports and health. Accordingly, we reached to the conclusion that "Sportology" should be a new scientific wisdom and its purposes are:

- to calrify the relation between sports and health.
- to deepen the respective specialized sciences involved in "Sportology".
- to create and present opportunities where more effective and more efficient academic achievements can be given back to society.

These facts came to be our strong motivation in establishing this Academy.

'Integration' – The keyword for "Sportology"
These variety of studies which primarily should intimately relate to sports and health have not yet integrated so far. Thus, we realized that we have to create a new value out of these separated research fields and the most important keyword to achieve this aim should be "Integration". By integrating these studies as "sportology", we are sure to offer all of you a good opportunity to think how important sports are for real health of the human beings.

Program of the Inaugural International Academy of Sportology
We are pleased to announce that, this time, 6 distinguished professors who play active parts in the various research fields from all over the world will join us as special lecturers and 60 presentations are on poster. Additionally, the luncheon seminar by the 2 Olympic gold medalists and the reception party where we expect the lively discussion and communication are also scheduled.
We promise a memorable and rewarding experience to all of you.

The International Academy of Sportology has been established in Japan and started as a small movement, however, we believe it will widely spread to the world as an integrated concept.
We do hope that this Congress will be the beginning of such a global effort through the colleagues and friends of Sportology. Please join with us for this Congress in Tokyo and let us work together in this endeavor. We welcome your input and suggestions, and we look forward with great anticipation to meeting with you then.

Februay, 2011

OGAWA Hideoki, MD, PhD
Charter Founder, International Academy of Sportology
CEO, Juntendo University, Tokyo

GENERAL INFORMATION

Period:	Saturday, March 5, 2011
Venue:	ARIYAMA NOBORU Memorial Hall (Bldg. 7, Juntendo University, Tokyo, Japan) http://www.juntendo.ac.jp/english/access/index.html
Official Language:	English
Registration:	Free by joining the Academy *see* http://www.ia-sportology.jp/english_html/registration.html http://www.ia-sportology.jp/japanease_html/registration_ja.html
Under the Auspice of:	Juntendo University International Center Mizuno Sports Promotion Foundation Takeda Medical Research Foundation
Supported by:	Ministry of Education, Culture, Sports, Science and Technology, Japan Ministry of Health, Labour and Welfare, Japan The Yomiuri Shimbun

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Juntendo University Graduate School
2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, JAPAN
TEL +81-3-5802-1020
FAX +81-3-3813-3622
E-mail info@ia-sportology.jp
URL http://www.ia-sportology.jp

ORGANIZATION

Organization of the International Academy of Sportology

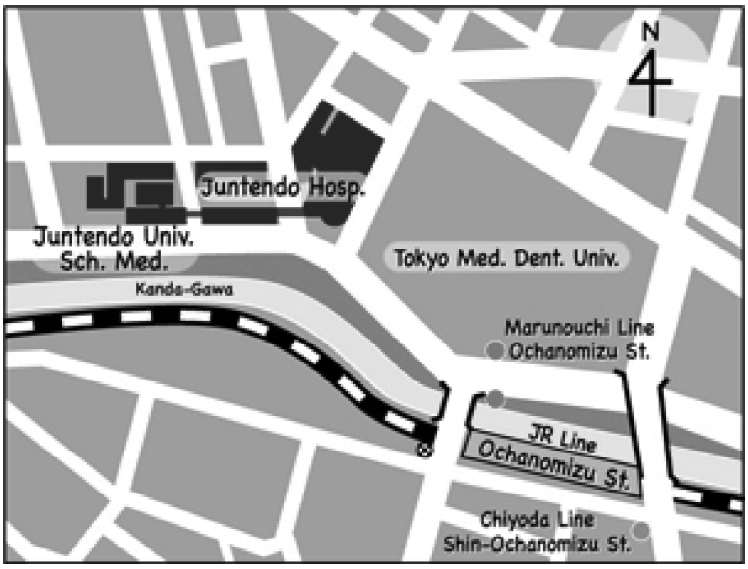
President:	OGAWA Hideoki (CEO, Juntendo University)
Honorary Presidents:	Pierre LEFEVBRE (Emeritus Professor, University of Liège, former President of International Diabetes Federation) Mladen VRANIC (Emeritus Professor, University of Toronto)
Vice Presidents:	KAGAYA Atsuko (Former President, Japan Women's College of Physical Education) KUBOTA Kisou (Emeritus Professor, Kyoto University) SAEKI Toshio (Emeritus Professor, University of Tsukuba)
Advisers:	KANAZAWA Ichiro (President, Science Council of Japan) KARASAWA Yoshihito (Former President, Japan Medical Association) KONO Yohei (President, Japan Association of Athletics Federations) MORI Yoshiro (President, Japan Sports Association) TAKAKU Fumimaro (President of the Japanese Association of Medical Sciences, President of Jichi Medical University) YAZAKI Yoshio (President of the National Hospital Organization, President of the 28th General Assembly of the Japan Medical Congress)
Members of the Board of Directors:	KOMINAMI Eiki (President, Juntendo University) KAWAMORI Ryuzo (Director, Sportology Center, Juntendo University) Scott K. POWERS (Professor, University of Florida) MURAOKA Isao (Dean, Faculty of Sport Sciences, Waseda University)

Local Organizing Committee of the Inaugural International Academy of Sportology

Chairman:	OGAWA Hideoki (CEO, Juntendo University)
Vice-chairman:	KOMINAMI Eiki (President, Juntendo University) NOGAWA Haruo (Dean, School of Health and Sports Science, Juntendo University) TOMINO Yasuhiko (Dean, School of Medicine, Juntendo University)
Chairman of the Financial Committee:	DAIDA Hiroyuki (Professor, Juntendo University)
Secretary General:	KAWAMORI Ryuzo (Director, Sportology Center, Juntendo Univesity)

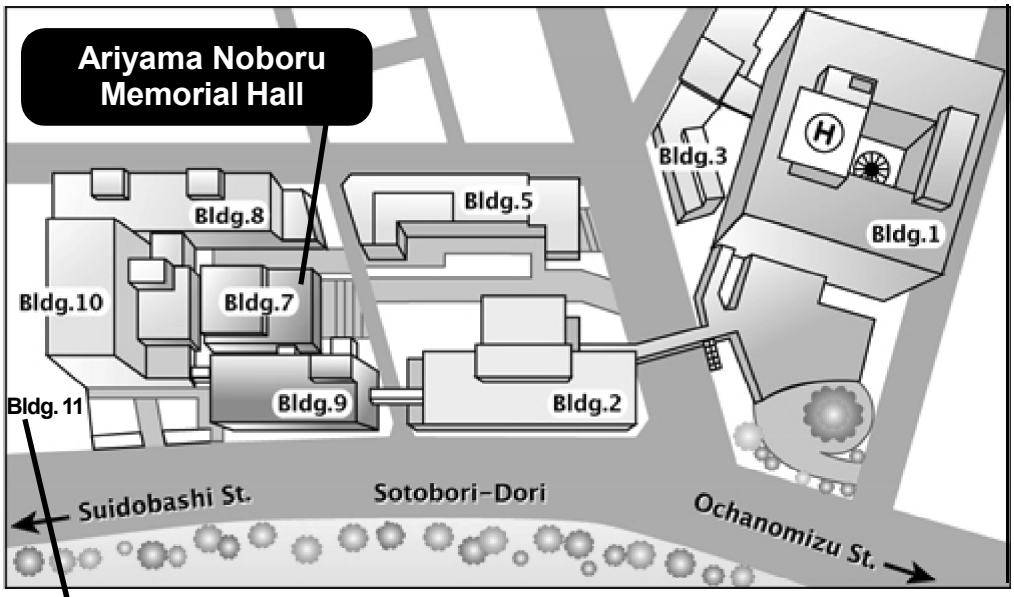
CONGRESS SITE

Access



JR : Chuo-line & Sobu-line "Ochanomizu Station"
Subway : Marunouchi-line "Ochanomizu Station"
Chiyoda-line "Shin-Ochanomizu Station"
* Approx. 8 min on foot from the stations

Juntendo University

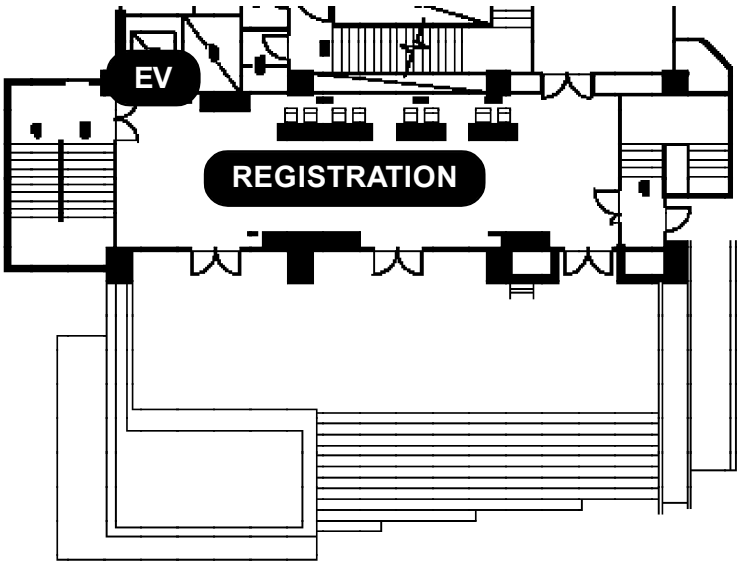


Hongo 2-1-1, Bunkyo-ku,Tokyo 113-8421,Japan
Telephone : 81-3-3813-3111

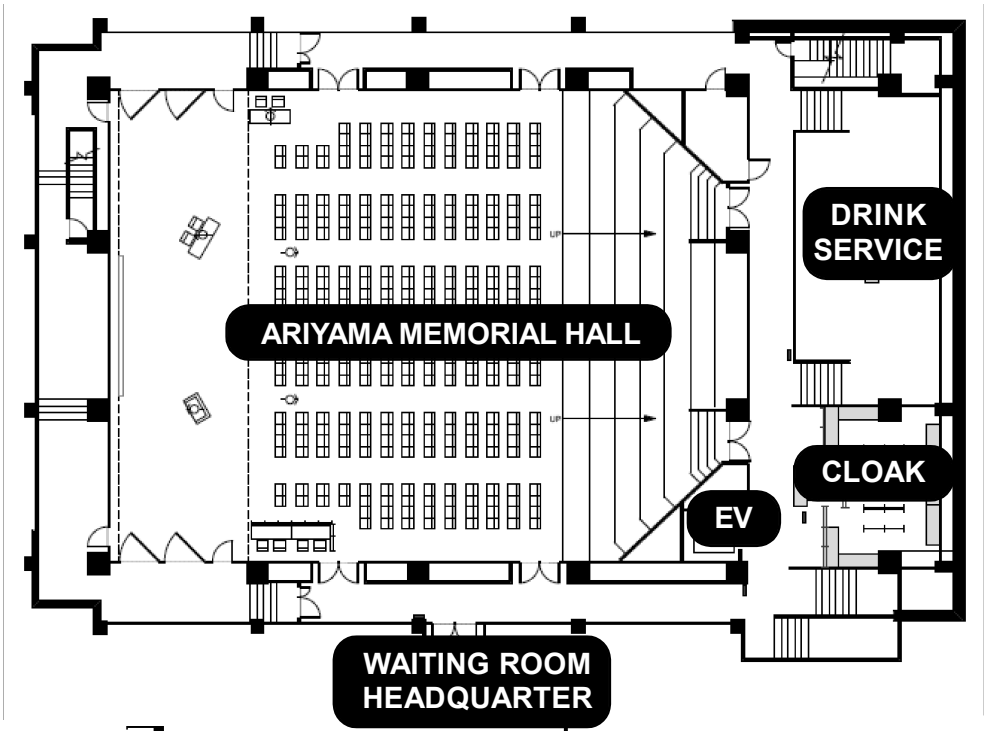
* Reception Party will be held on the 19th floor
of the Century Tower (Bldg. 11)

Floor Plan

<1F>
Entrance



<3F>
Oral
Session



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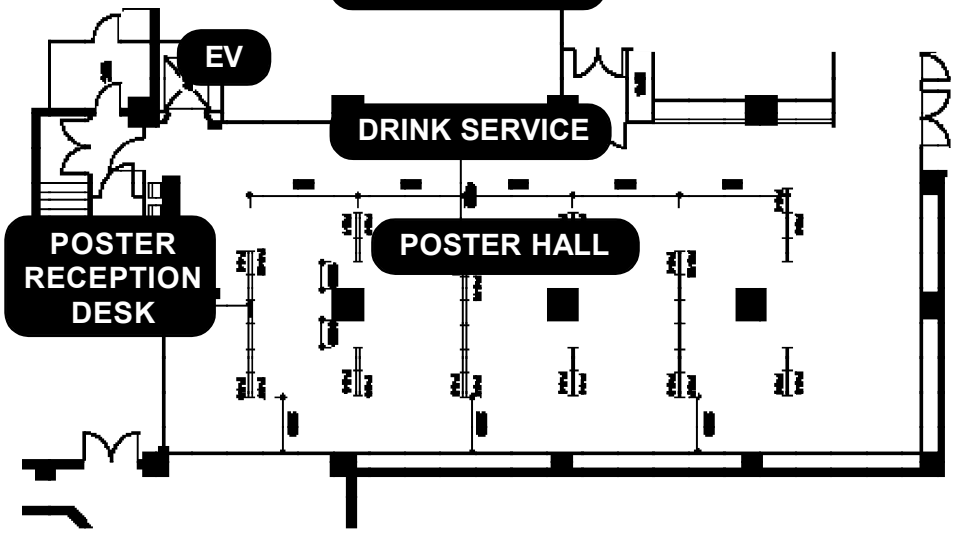
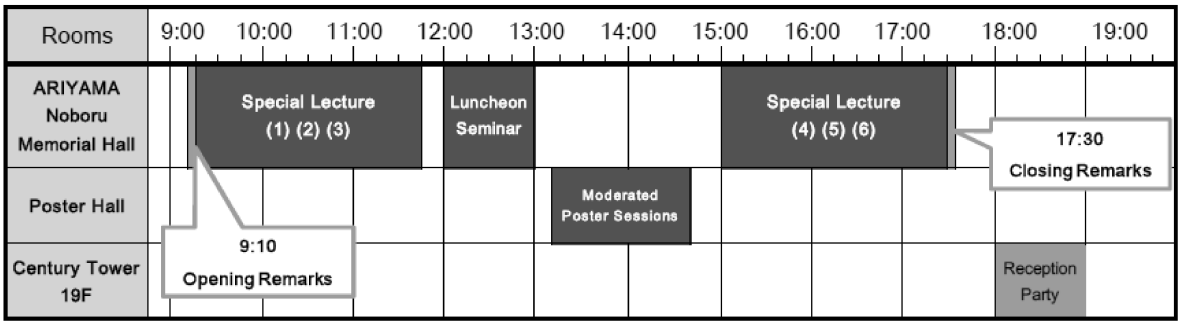
Poster
Session



PROGRAM

Program-at-a-Glance



Program

09:10- Opening Remarks: OGAWA Hideoki (CEO, Juntendo University)

09:15-10:05 Special Lecture 1 "The role of exercise and nutrition for obesity and metabolic syndrome"
Chair: KANEKO Kazuo (Juntendo University)
Lecturer: MORITANI Toshio (Kyoto University)

10:05-10:55 Special Lecture 2 "Neurodevelopment of the pediatric athlete: concepts for pediatricians"
Chair: YAMASHIRO Yuichiro (Juntendo University)
Lecturer: Donald E. GREYDANUS (Michigan State University)

10:55-11:45 Special Lecture 3 "The diabesity epidemy: gluttony, sloth or both?"
Chair: KAWAMORI Ryuzo (Juntendo University)
Lecturer: Pierre LEFEVBRE (University of Liège)

12:00-13:00 Luncheon Seminar "In pursuit of excellence: decisive moments for the Olympic gold medals"
(*sponsored by:* Hisamitsu Pharmaceutical Co., Inc.)
Chair NOGAWA Haruo (Juntendo University)
Lecturers: TOMITA Hiroyuki (Juntendo University)
SUZUKI Daichi (Juntendo University)

13:10-14:40 Moderated Poster Sessions

15:00-15:50 Special Lecture 4 "Redox control of disuse muscle atrophy"
Chair: NAITO Hisashi (Juntendo University)
Lecturer: Scott K. POWERS (University of Florida)

15:50-16:40 Special Lecture 5 "Evolvement of sports cardiology in Europe"
Chair: DAIDA Hiroyuki (Juntendo University)
Lecturer: Hugo SANER (University Hospital of Bern)

16:40-17:30 Special Lecture 6 “Probabilistic models of human sensorimotor control”
Chair: KITAZAWA Shigeru (Juntendo University)
Lecturer: Daniel WOLPERT (University of Cambridge)

17:30- Closing Remarks: KAWAMORI Ryuzo (Juntendo University)

18:00-19:00 Reception Party (@Century Tower (Bldg. 11) 19F)

Moderated Poster Sessions 13:10-14:40

P-1 “Brain”

Chair (Moderator): UKA Takanori (Juntendo University)

- 1 SUDO M. M. (Juntendo University)
  Effects of physical performance and language proficiency on brain activation: from a social cognition viewpoint
- 2 YOKOI Atsushi (The University of Tokyo)
  Flexible switching of multiple internal models during bimanual movement
- 3 NAKAZAWA Tomomi (Juntendo University)
  Influence of short-time COORDINATION motor tasks on response time
- 4 UDA Munehiro (Juntendo University)
  Differences in the amounts of nitrated proteins and superoxide dismutase in hippocampus of adult and middle age rats
- 5 KOHMURA Yoshimitsu (Juntendo University)
  Gender differences in saccadic eye movement among students at a sports university
- 6 UKA Takanori (Juntendo University)
  Correlation of fMRI signals and DWI during a saccade task
- 7 YANAGITA Shinya (Tokyo University of Science)
  Short-term treadmill running increase expression of ⊿FosB in several brain regions
- 8 TAKAHASHI Toshimitsu (Juntendo University)
  Determination of callosal connections contributing to interaction of responses to faces
- 9 HIRASHIMA Masaya (The University of Tokyo)
  Distinct motor plans enable simultaneous adaptation to conflicting force fields
- 10 MOTOI Yumiko (Juntendo University)
  Establishment of a mouse model of dementia and exercise treatment
- 11 UCHIDA Yusuke (Waseda University)
  The influence of time-scale changes in movement on mental images and prediction
- 12 HOMMA Hirotomo (Juntendo University)
  Evaluation of Olfactory dysfunction in Parkinson’s disease by using smell identification card kit

P-2 “Life style and genetic factor”

Chair (Moderator): MAEDA Shiro (RIKEN Center for Genomic Medicine)

- 1 FUJIBAYASHI Kazutoshi (NTT Medical Center Tokyo)
  The impact of the lifestyle on proteinuria and estimated glomerular filtration rate (eGFR)
- 2 FUKUDA Hiroshi (Juntendo University)
  Preliminary evaluation of the Japanese national project: specialized health screenings and health guidance for metabolic syndrome
- 3 SOMEYA Yuki (Juntendo University)
  Early development of hypertension and diabetes mellitus in the alumni of the faculty of physical education
- 4 IMAMURA Minako (RIKEN Center for Genomic Medicine)
  Rs10906115 in CDC123/CAMK1D locus and rs1359790 near SPRY2 are associated with susceptibility to type 2 diabetes in a Japanese population
- 5 MAEDA Shiro (RIKEN Center for Genomic Medicine)
  Association of single nucleotide polymorphisms within genes encoding sirtuin families with diabetic nephropathy in Japanese subjects with type 2 diabetes
- 6 YASUNAGA Akitomo (Bunka Women’s University)
  Daily physical activity and cognitive function in older Japanese adults
- 7 ORITA Hajime (Juntendo Shizuoka Hospital)
  Serum fatty acid synthase as a marker of Esophageal neoplasia
- 8 Gulanbar OBULHASIM (Juntendo University)
  dbpA mRNA up-regulated in NBNC and metabolic syndrome high risk patients with hepatocellular carcinoma

P-3 “Circulation”

Chair (Moderator): MAKITA Shigeru (Saitama Medical University)

- 1 NAGAOKA Isao (Juntendo University)
  Evaluation of the effect of flavangenol on serum lipid peroxide level and development of atherosclerosis in spontaneously hyperlipidemic B6.KOR-Apoeshl mice
- 2 TANO Takatoshi (Juntendo University)
  Computer-assisted retinal vessel measurement in elderly Japanese patients: correlation between right and left eyes
- 3 MATSUSHITA Satoshi (Juntendo University)
  Continuous exercise after cardiovascular surgery enhances cardiac recovery
- 4 FUKAO Kosuke (Juntendo University)
  Voluntary exercise ameliorates progression of atherosclerotic lesions in apolipoprotein E-deficient mice: protective role against systemic and vascular inflammation
- 5 NAKAGATA Takashi (Juntendo University)
  Effect of habitual cigarette smoking on maximal aerobic capacity and cardiorespiratory responses
- 6 SUGIHARA Masami (Juntendo University)
  Effects of voluntary exercise on viability and prognosis of DCM model mice
- 7 OKUYAMA Shizuyo (Keio University)
  Relationship between blood flow velocity and blood pressure during static handgrip exercise in elderly women
- 8 MIYAZAKI Ryo (Doshisha University)
  Effects of a long-term pedometer-based physical activity program on atherosclerotic risk factors among older adults
- 9 IKEDA Keiichi (Juntendo University)
  Changes of blood biomarkers for arteriosclerosis in young throwers
- 10 KAGOHASHI Yukiko (University of Shimane)
  Effective supplementation of n-3 polyunsaturated fatty acid for aerobic training
- 11 NAKAE S. (Doshisha University)
  Relationship between energy expenditure estimated by doubly labeled water method and body composition, physical fitness in primary school children

P-4 “Sports sociology”

Chair (Moderator): NAKAYAMA Keiichi (Meikai University)

- 1 TAKAHASHI Toshie (Juntendo University)
  Determinants to create customer satisfaction at public sport facilities in Japan
- 2 TOMEI Yumi (Juntendo University)
  Japanese adults’ gender egalitarian attitude in the sports world
- 3 OKAYASU Isao (Tokyo International University)
  Inbound leisure & sport tourists to Japan
- 4 NOGAWA Haruo (Juntendo University)
  International comparison of Sport for All promotion campaigns
- 5 YASUMITSU Tatsuo (Juntendo University)
  Effects of the short-time coordination exercise program during school recess on agility of elementary school students
- 6 JODAI Keiko (Juntendo University)
  Career transition of professional football players in Japan:10 years after
- 7 WATANABE Yasuhiro (Juntendo University)
  Market segmentation of professional golf tour tournament in Japan: an analysis of professional golf spectators
- 8 WON Jung-uk (Shizuoka Sangyo University)
  Comparative analysis of sport spectator motives between South Korea and Japan

P-5 “Muscle metabolism”

Chair (Moderator): HAYASHI Tatsuya (Kyoto University)

- 1 IWABU Masato (The University of Tokyo)
  Adiponectin and AdipoR1 regulate PGC-1α and mitochondria by Ca^{2+} and AMPK/SIRT1
- 2 EGAWA Tatsuro (Kyoto University)
  Caffeine acutely modulates signaling mechanisms of glucose transport and protein synthesis in rat skeletal muscle
- 3 SATO Koji (Ritsumeikan University)
  DHEA administration and exercise training improves insulin resistance in obese rats
- 4 TAKENO Kageumi (Juntendo University)
  Gene expression profiling in skeletal muscle related to athlete's paradox
- 5 IKEDA Shin-ichi (Juntendo University)
  Macrophages are necessary for exercise-induced enhancement of insulin sensitivity in skeletal muscle
- 6 MANABE Yasuko (Tokyo Metropolitan University)
  Development of the cultured-muscle cell (C2C12) contraction system by electric stimulation
- 7 YAMADA Yuka (Waseda University)
  Chronic adaptations and acute hormonal responses to resistance exercise in rugby footballers and non-athlete males
- 8 KUBOTA Atsushi (Juntendo University)
  Effects of blood flow restriction on muscle atrophy and weakness of knee extensor and flexor muscles
- 9 ZHENG Dong-mei (Juntendo University)
  Autophagy is suppressed in soleus and plantaris muscles by resistant exercise
-10 KUREBAYASHI Nagomi (Juntendo University)
  Effects of various types of Ca^{2+} regulation systems on differentiation and hypertrophy in skeletal muscle cells.
-11 KAKIGI Ryo (Juntendo University)
  Effects of intermittent heat stress with or without strength training on rat skeletal muscle
-12 NARAOKA Yuna (Juntendo University)
  Effect of heat shock protein 70 on macrophage induced inflammatory cytokines

P-6 "Musculoskeletal system"

Chair (Moderator): KATAMOTO Shizuo (Juntendo University)

- 1 KOYAMA Keiji (Juntendo University)
  Difference in the impact force and muscle activity during barefoot and shod walking
- 2 WATANABE Keisuke (Juntendo University)
  Characteristic of leg stiffness in children
- 3 ISHIKAWA Takuji (Juntendo University)
  Effect of body weight, body mass index and bone metabolism maker on nutrition frequency in female long distance runner
- 4 MARUYAMA Asako (Juntendo University)
  Influence of outdoor sports experience on bone mineralization in female athletes
- 5 KANEKO Haruka (Juntendo University)
  Characteristics of the patients with knee osteoarthritis improving their symptoms by home exercise detected by the cartilage degradation marker
- 6 KISHIMOTO Keiichi (Kobe University)
  Sequential changes in cervical spine alignment in collegiate American football athletes
- 7 SAGA Norio (Juntendo University)
  Effect of dynamic balance training using the caster board on postural control for female university students
- 8 KASHIYAMA Taku (Juntendo University)
  Detection of BACE1-mediated activation of neuregulin 1-erbB signaling using a cleavage site specific antibody
- 9 HANYU Ryo (Tokyo Medical and Dental University)
  Anabolic action of PTH signaling on bone activated expression of a clock gene, Per-1

INSTRUCTIONS

For Speakers in the Oral Sessions

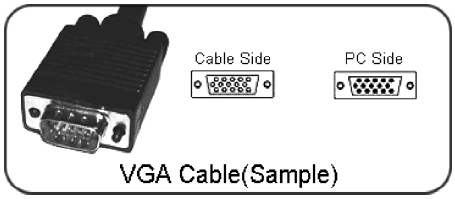
All presentation must be in English and all presentation data should be prepared in English.

Only PC presentation will be available. Slide projector, overhead projector and video cannot be used.

1) Compatible personal computers
Please bring your own PC and the back-up data saved in the PC media: CD-R (only the hybrid (ISO 9660) format)/USB memory. Any other media such as MO, DVD, etc. cannot be used. So as to avoid the virus infection, please scan your data with updated anti-virus software beforehand.

2) Animation and sound
Animation and sound functions will be available.

3) Instructions for the registration of presentation data
- Bring your PC with the AC adaptor and auxiliary output adaptor (D-sub 15 pin). If necessary, be sure to bring a connector.



- The monitor size is XGA (1024x768). For proper data projection, please adjust your screen setting to XGA.
- Please cancel your screen saver and power saving setting in advance, especially if your data includes animation and sound.
- Our PC operator will contact you in the waiting room to pick-up your PC at latest 30 minutes prior to your presentation. He will help you to check the connection. Please visit the PC Operation Desk near the speaker's podium on the left stage seen from the audience.
- Please be sure to pick up your PC at the PC Operation Desk after your presentation.

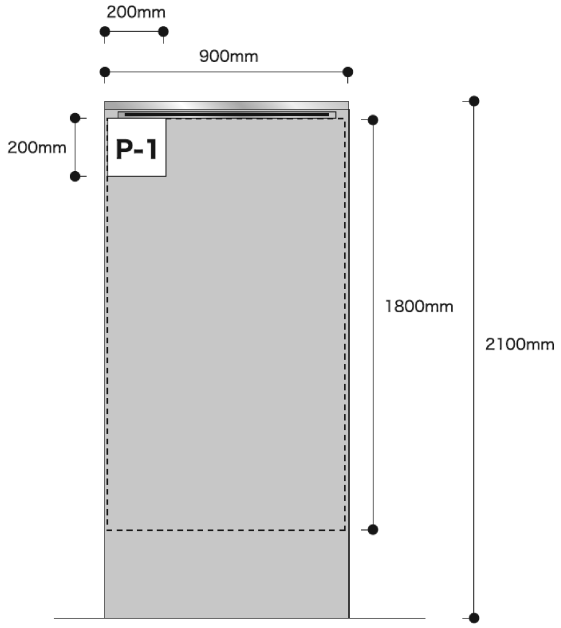
4) At your presentation
Use the mouse and keyboard on the speaker's podium. Your PC will be connected to them.

For Speakers in the Poster Sessions

All posters must be prepared in English and all presentations should be in English.

1) How to prepare and set up the posters
- The poster board space available to each poster is 90 cm width and 180 cm height.
- Only the program number (Ex. P-1-1) will be posted by the Secretariat at the top of the assigned space. Please use the space with the label indicating your program number.
- Each poster must be labeled by authors with the title of presentation, authors' names and their affiliation.
- All the materials should be simply and clearly prepared. Only thin papers or hard cards can be used. Do not mount a heavy material.

- Tacks and ribbon tags for the presenters will be provided by the Secretariat. Please visit the Poster Reception Desk located in the Poster Hall (B1F) before poster set-up.



2) Instructions for moderated presentation

Presenters are requested to be present in front of their posters during the period of Poster Session. Please wear the ribbon tags stuck on the poster board.
Seven minutes are allocated to each presentation: 5 minutes for presentation and 2 minutes for discussion. Please follow the chairpersons' expedition.
No visual equipment is available for presentation.

3) Schedule for Poster Sessions

Set-up	8:30- 9:10
Moderated Presentation	13:10-14:40
Removal	17:30-18:00

* Note that authors are responsible for setting up and removing their posters.
* All materials which have not removed before 18:00 will be disposed.

For Chairs in the Oral Sessions

All sessions must be organized in English.

Please be ready in the Next Chairs' Seats in the right-front side of the presentation room at latest 15 minutes prior to your session. Please organize your session according to the allocated time schedule. No time-keeping system is available.

For Chairs (Moderators) in the Poster Sessions

All sessions must be organized in English.

Moderated presentation will be held during 13:10-14:40.

Ribbon tags for the chairs (moderators) will be provided by the Secretariat. Please visit the Poster Reception Desk located in the Poster Hall (B1F) at latest 15 minutes prior to the poster session to appeal your attendance and receive the ribbon tag for chairs (moderators).

Seven minutes are allocated to each presentation: 5 minutes for presentation and 2 minutes for discussion. Please be sure to organize your session according to the allocated time schedule. No time-keeping system is available.

Sponsored by:

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(alphabetical order; as of February 15, 2011)

ABSTRACTS

SL-1 The role of exercise and nutrition for obesity and metabolic syndrome

Toshio Moritani, PhD, FACSM
Kyoto University, Japan

Japanese daily energy intake per person reached a peak value of 2,226 Kcal in 1975 and has since dramatically dropped to 1,902 Kcal in 2004 which is nearly identical to the values immediate post World War II. However, obesity has sharply increased despite this dramatic decline in energy intake. This may be, in part, the result of a "relative energy surplus" caused by a ***decline in energy expenditure*** far exceeding ***the decreased energy intake*** due to modern industrialization. Bray has proposed the "MONA LISA" hypothesis, an acronym for ***M**ost **O**besities k**N**own **A**re **L**ow **I**n **S**ympathetic **A**ctivity* indicating that obesity is associated with a relative or absolute reduction in the activity of the thermogenic component of the sympathetic nervous system. It is now well recognized that "middle age obesity" is strongly associated with a depressed autonomic nervous system (ANS) activity and aging, particularly the sympathetic thermogenic responses to a high-fat diet and irregular food intake pattern.

Our series of studies have suggested a potential reversibility in ANS activity regulating fat metabolism and appetite control by regular exercise training in middle aged individuals and obese children with depressed ANS activity.

In other words habitual exercise plays a vital role in enhancing not only fat and glucose metabolism, but also ANS activities in the prevention of obesity and appetite control. Recent studies have clearly indicated that exercising obese individuals have a much lower mortality rate and incidence of diseases than lean individuals with little or no exercise. A possible explanation could be due to the effects of exercise on immune functions and myocytokines in preventing and improving of lifestyle-related diseases. Finally, our recent studies on functional muscle electrical stimulation on glucose utilization during hyperinsulinemic euglycemic clamp will be discussed together with the most recent topics on brain derived neurotrophic factors (BDNF) that appear to influence energy metabolism, appetite and aspects of neuro-cognitive function through interfacing with IGF-1, insulin, and GLP-1. Thus, a lack of exercise as characterized by a sedentary lifestyle, and an unhealthy diet may lead to accelerated ageing, diseases of the body and brain, and an overall decline in the quality of life.

SKETCH OF CAREER
<Education>
PhD, University of South California, USA
<Professional Employment>
Professor and Director,
Laboratory of Applied Physiology, Graduate School of Human and Environmental Studies, Kyoto University, Japan
<Research Interest>
Exercise physiology and applied physiology

SL-2 Neurodevelopment of the pediatric athlete: concepts for pediatricians

Donald E. Greydanus, MD, Dr HC (ATHENS)
Michigan State University, USA

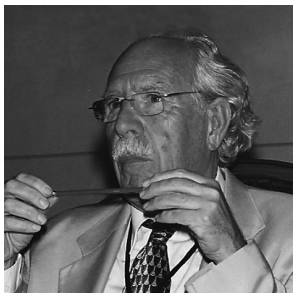
Understanding the neurodevelopment of the *Pediatric Athlete* and how this development impacts sports participation is critical for clinicians to provide parents, coaches, and sports organizers with valuable information about how to select activities for their children that will have a positive impact on their overall growth and development as well as optimize their benefit from sports play. The term **neurodevelopment** refers to the synthesis of various functions of the pediatric athlete and is considered in this presentation. The term includes *brain function, motor function, balance, perception, agility, flexibility, strength, endurance, arousal, attention, memory, problem solving, analysis, sorting, discrimination, selecting, processing speed, perceptual ability, motor skills, visual acuity, tracking, breathing, balance, awareness of self, awareness of others, awareness of objects, awareness of others in relation to self, control of extremities, hearing, language, comprehension, thinking ability (i.e., concrete, abstract), ability to follow rules, ability to generalize concepts, and ability to understand concepts.*

Stories of child prodigies who began to learn a specific sport before age three stimulate parents to question whether or not they also should be enrolling their very young children in such aggressive training programs. The participation of these athletes in sports-related activities plays a major role in the lives of millions of parents and children in numerous countries. Many professionals guide the pediatric athlete to sports participation as a means of socialization, physical skill building, and as a way of teaching pro-social behaviors. In order to effectively engage in and benefit from this involvement, all children and adolescents need to have mastered various fundamental skills, as reviewed in this presentation. Neurodevelopment refinement is needed for the pediatric athlete to move from sports participation to enhance healthy growth and development while optimizing participation at a competitive level. At this level, skills must be highly developed which severely limits who can be involved in competitive sports as well as who excels and are eligible to play at a non-professional championship or professional level.

Physicians and health care sports professionals (especially those with specialized training in sports medicine, sports psychology, coaching, occupational therapy, kinesiology, others) should provide information to other professionals and parents about issues related to successful sports participation of the pediatric athlete. These professionals may find themselves being asked multiple questions about these subjects. Professionals who have a basic understanding of pediatric neurodevelopment can more effectively address issues and concerns related to healthy sports participation. They will also be prepared to guide parents and their pediatric athlete towards making wise decisions about selecting sport activities that will be the most beneficial to this athlete at the best ages and levels.

SKETCH OF CAREER
<Education>
MD, College of Medicine & Dentistry of New Jersey, USA
<Professional Employment>
Professor,
Department of Pediatrics and Human Development,
Michigan State University College of Human Medicine, USA
Director of the Pediatrics Residency Program,
Michigan State University/Kalamazoo Center for Medical Studies in Kalamazoo, USA
<Research Interest>
Adolescent health

SL-3 The diabesity epidemics: gluttony, sloth or both?



Pierre Lefèbvre, MD, PhD, FRCP, MAE
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According to the International Diabetes Federation (IDF), the number of people with diabetes in the world is currently close to 300 million and projections indicate that this number may be well over 430 million at the 2030 horizon. Over 90% of people affected by diabetes have the Type 2 form of the condition. Long termed “maturity-onset” diabetes, the condition now affects more and more children and adolescents. It has long been recognized that Type 2 diabetes has a strong genetic component but, at a time genetics has made huge progress, one must today recognize that, compared to clinical risk factors alone such as an increase in body mass or a family history of diabetes, over 30 identified genetic variants associated with the risk of diabetes have an almost negligible effect on the ability to predict the future development of the condition in a given individual.

It is generally agreed that Type 2 diabetes is characterized by an inadequate insulin response of the beta-cell of the islets of Langerhans of the pancreas to the progressive insulin resistance that typically accompanies advancing age, inactivity and weight gain. Gluttony (over-nutrition) and sloth (under-exertion) are two of the seven *cardinal sins* already recognized 15 centuries ago. Their respective roles in the development of the current “diabesity” epidemics will be discussed. Emphasis will be put on the *physical inactivity paradigm* (Katzmazyk, 2010) in which the potential role that all aspects of human movement can play in impacting health is developed. Opposing the *tsunami* that represents the diabesity epidemics will require more than simple slogans such as “eat less, walk more” or current almost universal life style recommendations such as “achieving 150min of moderate-to-vigorous physical activity per week”…

SKETCH OF CAREER

<*Education*>
MD, University of Liège, Belgium
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Emeritus (active) Professor & Clinical Consultant,
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<*Research Interest*>
Physiology and pathophysiology of metabolic regulations
with particular emphasis on glucagon, insulin and physical exercise

SL-4 Redox control of disuse muscle atrophy

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Prolonged periods of contractile inactivity results in atrophy skeletal muscle fibers. This disuse-induced muscle atrophy results from both increased proteolysis and decreased protein synthesis. Investigations of the cell signaling pathways that regulate disuse muscle atrophy have increased our understanding of this complex process and emerging evidence implicates oxidative stress as a key regulator of cell signaling pathways leading to increased proteolysis and muscle atrophy during periods of prolonged disuse. This tutorial lecture will discuss the role of reactive oxygen species in the regulation of inactivity-induced skeletal muscle atrophy. Specifically, this presentation will focus on a unique type of disuse muscle atrophy (i.e., mechanical ventilation-induced atrophy of respiratory muscles). The presentation will provide an overview of muscle proteases, outline intracellular sources of reactive oxygen species, and summarize the evidence that connects oxidative stress to signaling pathways contributing to disuse muscle atrophy. Moreover, this lecture will also address the specific role that oxidative stress plays in signaling pathways responsible for muscle proteolysis and highlight gaps in our knowledge of disuse muscle atrophy. By presenting unresolved issues and suggesting topics for future research, it is hoped that this presentation will serve as a stimulus for the expansion of knowledge in this exciting field.

SKETCH OF CAREER

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Effects of exercise and inactivity on redox signaling and gene expression of both cardiac and respiratory muscle

SL-5 Evolvement of sports cardiology in Europe

Hugo Saners, MD
University Hospital of Bern, Sweitzerland

Sports cardiology is becoming an emerging topic in cardiovascular medicine in Europe. Therefore, 5 years ago the European Association for Cardiovascular Prevention and Rehabilitation EACPR decided to create an official section within the association which is dedicated to sports cardiology with the aim to promote science, training, education, and practice in this field.

Important topics in sports cardiology are: Athletes and arena safety, screening before sports participation, prevention of sudden death in athletes, doping and cardiovascular disease but also increasing competence in the evaluation of particular congenital and acquired cardiovascular diseases related to leisure time physical activity as well as semi-professional and master athletes sports activities.

The presentation of Prof. Saner will give information and insights into the development of sports cardiology as a cardiology subspecialty in Europe.

SKETCH OF CAREER
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SL-6 Probabilistic models of human sensorimotor control

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The effortless ease with which humans move our arms, our eyes, even our lips when we speak masks the true complexity of the control processes involved. This is evident when we try to build machines to perform human control tasks. While computers can now beat grandmasters at chess, no computer can yet control a robot to manipulate a chess piece with the dexterity of a six-year-old child. I will review our recent work on how the humans learn to make skilled movements covering probabilistic models of learning, including Bayesian and structural learning and how the brain makes and uses motor predictions.

SKETCH OF CAREER
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Computational and experimental approaches to human sensorimotor control

P-1-1 Effects of physical performance and language proficiency on brain activation: from a social cognition viewpoint

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Juntendo University[1)], Teikyo Heisei University[2)], Tokyo Denki University/National Institute of Sensory Organs[3)]

Objective: The purpose of this study was to investigate the interrelationships between physical performance and language proficiency through brain activities, especially from the viewpoint of social cognition.

Methods: Thirty healthy Japanese college undergraduate and graduate students served as subjects. There were 3 sessions in this study: fMRI session, language session and social cognition session. In the fMRI session, the subjects were instructed to imagine they were performing coordination training while viewing video images of exercises. Also, they read English passages silently under fMRI. In the language session, they took the official TOEIC test, and the standardized tests of reading rate and vocabulary size for the measurement of their English proficiency. In the social cognition session, social cognitive investigation was conducted using two specific components, i.e., memory span and empathizing. The Japanese version of the reading span test (RST) was employed to measure memory span as one of the quantified indices of working memory which fulfills a dominant role in social cognition. We obtained 4 parameters using the RST score. Empathizing—the ability to recognize other's emotions and mental states—was measured by self-reports on the Systemizing, Empathy, and Autism Spectrum Quotients (SQ, EQ and AQ).

Results: To evaluate the associations among physical performance, language competence and social cognitive ability, correlation analysis was conducted for physical parameters, social parameters (RST, SQ, EQ and AQ) and TOEIC scores (total, listening and reading scores) together with reading rate and vocabulary size, which reflect learning and performance abilities of English as a second language. The results of the analyses revealed that TOEIC scores showed strong correlation with reading rate and some correlation with vocabulary, but showed no dependence on the RST and empathizing parameters. The RST parameters correlated with one parameter of physical performance, endurance and also with the EQ rating. Furthermore, it should be noted that gender-specific relations were observed among English-related parameters, social and physical parameters. Regarding brain activation, in the coordination training task, BOLD (Blood Oxygenation Level Dependent) activation during the exercises by two persons was significant in comparison with that in exercises by one person in the left cuneus (Broadman Area: BA 17), the left precuneus, the left middle occipital gyrus, the fusiform gyrus (BA 37), and the right superior temporal gyrus. The activation of middle frontal gyrus and limbic lobe (BA 28) in the exercises by two persons significantly correlated with the AQ scores of the communication skill-related question item. The activation of cerebellum in the exercises as a follower significantly correlated with AQ total scores. The activation of middle occipital gyrus in the exercises by two persons significantly correlated with EQ scores. In the English reading task, TOEIC scores significantly correlated with the activity of the left lingual gyrus (BA 18), the right corpus callosum and the right parahippocampal gyrus, as did the RST rate with the right middle temporal gyrus, the right posterior cingulate gyrus, and the left superior temporal gyrus.

Conclusions: The fMRI findings indicate that exercises performed by two persons require more sophisticated communications than those by one person. Partner-led exercise might be accompanied by discomfort affection reflected by the insula activation. Persons with more autistic traits may undergo difficulties in the exercises by two persons, especially in the case of the person being a follower. In English reading by Japanese speakers, the activities of the loci may promote efficiency of visual and phoneme processing, inquiry to memory and communication between hemispheres. The results of this study suggest that physical performance and language proficiency are interrelated from the viewpoint of social cognition.

P-1-2 Flexible switching of multiple internal models during bimanual movement

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Background: Flexible bimanual action requires the brain to employ multiple internal models for each arm to predictively compensate for the mechanical interactions resulting from movement of the other arm. Although how the brain constructs multiple internal models remains a challenging problem (Shadmehr et al., 2010), several studies has demonstrated that two different internal models for the same arm movement are associated with whether the secondary arm is stationary or moving (Nozaki et al., 2006) and moving in the different directions (Howard et al., 2010). However, the mechanism how different internal models are associated with different movements of the other arm is largely unknown.

Hypothesis: Here we propose a possible learning mechanism for flexible switching of multiple internal models during bimanual movement control which is based on previous neurophysiological evidences. Neurons in primary motor areas are known to change their tuning pattern during adaptation to novel dynamics with contralateral arm (Gandolfo et al. 2000; Li et al. 2001; Gribble and Scott 2002), and some of them are continuously modulated by the movement direction of the ipsilateral arm (Rokni et al. 2003). Rather than “interference” to be suppressed, we propose that the neuronal signal arising from the different movements of the ipsilateral arm contributes to construct and switch between different internal models for the contralateral arm by differently recruiting elements of motor learning.

Methods: To test how the motor learning of the primary arm is affected by the kinematics of the secondary arm, we used a standard force field learning paradigm (Shadmehr et al., 1994). We had 24 right-handed subjects to perform centre-out bimanual reaching task holding the handles of 2 robotic manipulanda (Phantom 1.5 HF; SensAble Technologies, Woburn, MA, USA). We first trained the left arm with the right arm moving in a particular direction and then examined how this left arm training transferred to the same left arm movement as a function of movement direction of the right arm. During the training, we applied viscous force field only on the left arm. After the training, we randomly interleaved “catch trials” to measure the degree of motor learning transfer of the same left arm movement with different right arm movement directions. For catch trials, we employed both standard (null trial) and “error clamp” methods.

We also tested whether our conceptual model could explain the experimental behaviour. The model is mathematically formulated as a state space model (Thoroughman and Shadmehr, 2000; Donchin et al., 2003) described below.

$$e^{(i)} = \hat{f}^{(i)} - f^{(i)} \quad (1)$$

$$\boldsymbol{w}^{(i+1)} = \alpha \boldsymbol{w}^{(i)} + k\boldsymbol{r}^{(i)} e^{(i)} \quad (2)$$

Movement error, e is the difference between actual force, $f^{(i)}$ and predicted force, $\hat{f}^{(i)} = \boldsymbol{r}^{(i)T}\boldsymbol{w}^{(i)}$; output of the model is linear combination of connection vector, $\boldsymbol{w} = \left(w_1, w_2, \cdots, w_N\right)^T$ and neuronal signal arising from the movement of opposite arm, $\boldsymbol{r} = \left(r_1, r_2, \cdots, r_N\right)^T$ as shown in eq. (1). The value of $\boldsymbol{w}$ is updated trial-by-trial based on the movement error according to the eq. (2), where α is the constant between 0 and 1, k is the learning rate, the superscript i indicates the ith trial, and N is the number of element for the present model. We assumed that each element of $\boldsymbol{r}$ is a continuous function of the movement direction č of the other arm (Rokni et al., 2003), such as Gaussian tuning (Donchin et al., 2003).

Results: As predicted by our scheme, we found that the degree of transfer of motor learning within the same left arm movement was continuously influenced as a function of the movement direction of the right arm. And these behavioral results were well captured by our model.

Conclusion: The present results support our scheme. The scheme may account for a neural principle that allows the brain to coordinate movements between any and all body parts.

P-1-3 Influence of short-time COORDINATION motor tasks on response time

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The aims of COORDINATION exercise (CE) and training are mainly to experience redundant degrees of freedom of a moving organ and to organize control of movement. A recent brain imaging study that examined brain activity after complex CE, reported that this exercise activates not only frontal motor areas but also higher cortical areas such as prefrontal and mid-temporal regions (Mochizuki & Kirino, 2003). Therefore there is a possibility that such exercise may influence cognitive functions processed in the activated areas. Our previous report showed that changes in behavioral selection time (BST) [i.e., the difference between choice (CRT) and simple response time (SRT)] after CE correlates with the individual's performance of CE (Takeuchi et al., 2010). Namely, BST after CE for about fifteen minutes tended to be shorter for high performance players of CE and longer for low performance players. These findings indicate that, for unskillful players, the exercise 'load' (CE) on their neural system would be too strong. If so, the exercise time of CE should be set to a shorter time (i.e., making the exercise load lighter), then CE for unskillful players may also produce improvement of reaction ability. The present study focused on 'reaction ability', and investigated whether or not response times are altered by a short-time CE.

Eight female basketball players were asked to perform three response time tasks; simple response time task (SRT), choice response time task (CRT) and GO/NOGO choice response time task ($_{G/N}$CRT). These response tasks were performed before and after CE or walking exercise (WE). In CE, the subjects performed five different kinds of exercise for about three minutes. On another day, they carried out WE for 3 minutes at the speed of about 130 meters per minute, followed by response tasks.

On CRT, response time was slightly shortened after CE (no significant difference between CRT times before and after exercise; paired t-test, $p=0.056$). However, $_{G/N}$CRT after exercise was improved significantly (paired t-test, $p<0.05$). There were no such changes in response time after WE. Paired t-test did not show any significant difference between response times before and after WE (paired t-test, $p=0.48$ for CRT, $p=0.45$ for $_{G/N}$CRT).Our results indicate that reaction ability, such as behavioral selection time, were improved by short CE session. This suggests that sports players may be able to use CE as a prolusion for temporarily enhancing cognitive function such as judgment and/or choice of action.

P-1-4 Differences in the amounts of nitrated proteins and superoxide dismutase in hippocampus of adult and middle age rats

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Introduction Oxidative protein damage is associated with age related cognitive decline and neurodegenerative disease. One of the markers of the oxidative protein damage is a formation of 3-nitrotyrosine (3NT) in proteins. 3NT is arisen by the reaction between tyrosine and peroxynitrite ($ONOO^-$), which is formed by spontaneous reaction between nitric oxide ($NO\bullet$) and superoxide ($O_2^{-}\bullet$). The 3NT-containing proteins are known to accumulate in the brain of mild cognitive impairment, which is considered as a transition phase between normal aging and dementia [(1)]. In the normal brain, previous studies have shown that 3NT-containing proteins were increased with age and several proteins are identified as 3NT-containing proteins in aged animals [(2)]. However, the changes of protein nitration in the brain between adult and middle age have not been determined. Meanwhile, we have shown a formation of nitrated tryptophan residues by $ONOO^-$ in previous studies. We also have made 6-nitrotryptophan (6-NO_2Trp)-specific antibody and identified several nitrated-tryptophan containing proteins in the peroxynitrite-treated PC12 cells extracts [(3)] and in atopic-like dermal lesions of NC/Nga mice. However, it is not clear whether 6-NO_2Trp-containing protein exist in non-pathological conditions in vivo. The aim of this study is to determine whether protein expressions of 3NT- and 6-NO_2Trp- containing proteins and three kinds of superoxide dismutase, which are the major antioxidant enzymes for the inactivation of superoxide, were different in the hippocampus between adult and middle age F344 rat.

Materials and methods Sedentary male Fischer-344 (F344) rats of 6 (adult) and 12 months (middle aged) of age were used in this study. The rats were housed in individual cage under a 12-h light/dark cycle and provided with water and food *ad libitum*. The rats were deeply anesthetized and hippocampus was dissected, frozen in isopentane cooled to approximately -80 °C and stored at -80 °C. The hippocampus were homogenized in a lysis buffer containing 40mM Tris, 8 M urea, 4% CHAPS, 65 mM dithiothreitol, 1 mM EDTA and protease inhibitor. The homogenates were then centrifuged at 15000´g for 15 min, and the middle layer, containing the proteins, was carefully withdrawn. We measured 3NT- and 6-NO_2Trp-containing proteins in the hippocampus using standard Western blotting techniques. In addition, protein expression of manganese superoxide dismutase (Mn-SOD), extracellular superoxide dismutase (EC-SOD), and copper/zinc superoxide dismutase (Cu, Zn-SOD) were measured by Western blotting.

Results The amount of 3NT-containing proteins did not differ in the hippocampus of 12 months old rats with that of 6 months old rats. 6-NO_2Trp-containing proteins were detected in both 6 and 12 months old rats and there was no difference in the protein amount between 6 and 12 month old rats. The protein expression of both Mn-SOD and EC-SOD was not different in 6 and 12 months old rats hippocampus. On the other hands, Cu, Zn-SOD protein expression was increased in 12 months old rats compared with that of 6 months old rats.

Discussion In the present study, the amounts of the nitrated proteins were not different between 6 and 12 months old rats. This result indicates that oxidative protein damage has not been enhanced in the hippocampus of middle age rats. Meanwhile, we observed an increase of Cu, Zn-SOD protein expression in 12 months old rats. Therefore, the increase of Cu, Zn-SOD may prevent the enhancement of oxidative protein damage in the hippocampus of middle age rats.

(1) D. A. Butterfield et al, Brain Res. 2007, 1148: 243-248.
(2) C.M. Shin et al, Brain Res. 2002, 931:194-199.
(3) H. Kawasaki et al. Free Radic. Biol. Med. 2011, in press

P-1-5 Gender differences in saccadic eye movement among students at a sports university

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Dynamic visual acuity, the ability to distinguish a moving target, is an important ability for athletes. It has been reported that athletes have excellent dynamic visual acuity. A number of studies have investigated methods for measuring dynamic visual acuity and have reported results of these measurements for athletes. However, conducting basic research that includes investigating factors related to dynamic visual acuity is also necessary. Previous studies have reported that gender differences exist in dynamic visual acuity and that eye movement is related to dynamic visual acuity. Saccadic eye movement plays a central role in tracking a target which moves at a high speed. In the present study, we aimed to investigate gender differences in the velocity and latency of saccadic eye movement in order to obtain information on factors related to gender differences in dynamic visual acuity. We also investigated differences in eye movement data according to the type of sport in which subjects specialized. Subjects comprised 23 students (13 men, 10 women) attending a sports university with a mean age of 21.0 +/- 1.1 years. Fourteen of the subjects wore contact lenses, while the other nine did not wear any corrective lenses. Before entry into the study, written informed consent was obtained from the all subjects after a detailed explanation of the content of the experiment and the object of the study. Experimental tasks were performed to measure the dynamic visual acuity of subjects and their reactions to a target displayed on a screen. For dynamic visual acuity measurements, the ability of subjects to visually track and accurately distinguish a target moving horizontally in front of their eyes was evaluated. The velocity of the target, a Landolt ring, was gradually decreased from 49.5 rpm, and the velocity at which the subject was able to distinguish the position of the gap in the Landolt ring was recorded. For the reaction task, a target was shown on the right side of the screen immediately after disappearance of a target on the left side of the screen, and two reaction tasks, A and B, were performed. For reaction task A, subjects visually tracked the target as fast as possible, and for reaction task B, subjects pressed a switch as fast as possible after appearance of the target on the right side of the screen. During reaction task A, eye movement was recorded using an electro-oculography (EOG), and the latency and velocity of eye movement were analyzed based on the recorded results. All EOG signals were electrically amplified by an amplifier and were digitally recorded with data collection system. An electrode was placed laterally to each eye. During reaction task B, the time required for the subject to press the switch was measured as a simple reaction time. Analysis showed significant gender differences ($p<0.05$) in dynamic visual acuity and simple reaction time. However, no significant gender differences were observed for the velocity and latency of eye movement. Subjects in the present study exhibited gender differences in dynamic visual acuity but not in velocity and latency of eye movement. Moreover, no significant differences were observed for the results of eye movement between students specializing in ball sports and other students. It is suggested that gender differences in dynamic visual acuity are related to the accuracy of eye movement.

P-1-6 Correlation of fMRI signals and DWI during a saccade task

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Saccadic eye movements have been used as a measure for higher order brain function both in normal subjects and patients with neuropsychiatric disorder. Neural circuits mediating the execution of saccadic eye movements are fairly well known: cortical areas such as the frontal eye field (FEF), the parietal eye movement area, as well as subcortical areas such as the superior colliculus and brain stem regions have been identified as crucial gray matter regions for the execution of saccadic eye movements. How the activation of cortical gray matter regions is related to white matter structure, however, is currently unknown. To determine the relationship between the two, in this study, we measured activation of eye movement areas using functional magnetic resonance imaging (fMRI) during execution of an eye movement task, as well as white matter structure using diffusion weighted images (DWI) in the same subjects.

Twenty four normal subjects were examined in a 1.5T MRI scanner (Avanto syngo, Siemens). Visual images were presented via a digital visor (VisuaStim, Resonance Technology). Subjects were instructed to keep fixation on a small cross during baseline resting. During the eye movement task, subjects were instructed to make an eye movement toward a black circle when the color of the fixation point was green (pro-saccade task), and to make an eye movement in the opposite direction when the fixation point color was red (anti-saccade task). Blocks of pro-saccade trials and anti-saccade trials were randomly interleaved. Blood oxygen level dependent (BOLD) signals were acquired using the EPI sequence. Following the fMRI study, DWI for 64 axes was measured.

Intense BOLD signals were found in the FEF and the parietal eye movement area during the pro-saccade task compared to baseline activity during fixation. For each individual, we calculated the amount of activation in these 2 areas. We then searched for areas that had fraction anisotropy (FA) correlated with the BOLD activation. We found that the white matter in the left cerebellum had a strong positive correlation, and the white matter around the right putamen had a negative correlation with the amount of BOLD activation in eye movement areas across individuals. We further calculated the differential activation in the FEF and the parietal eye movement area during the anti-saccade task compared to the pro-saccade task for each individual. We found that the white matter in the left inferior occipital cortex had a strong positive correlation, and the white matter around the left primary visual cortex (V1) had a negative correlation with the amount of BOLD activation across individuals.

Our results show that individual differences in white matter structure, presumably related to myelination in the cerebellum, can predict the amount of brain activation necessary to evoke an eye movement in cortical eye movement areas. Overall, our findings suggest that individual differences in brain structure may possibly give rise to differential brain activation.

P-1-7 Short term treadmill running increase expression of ⊿FosB in several brain regions

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It is well known that physical exercise has an important role for improvement of brain functions, such as mental states and cognitions. Because several studies have reported that alteration of brain functions are closely related to the neuronal plasticity, physical exercise may induce enhancement of brain functions via induction of neuronal plastic changes. Indeed, recent studies have showed the influence of physical exercise on brain plasticity of rats, but little is known about the relationship between exercise conditions (i.e. duration, intensity, frequency) and brain plasticity. In this study, we examine the effects of short term treadmill running on expression of ⊿FosB protein in rats. ⊿FosB is one of the immediate early genes, and form long-lasting AP-1 complexes. These long-lasting AP-1 complexes mediate neuronal plasticity.

Male Wistar rats were used in this study. The rats performed low intensity treadmill running for 30mins per day during 1 day, 3, or 5 straight days. Running speeds were progressively increased from 15m/min to 20m/min. Control rats were placed on non-driven treadmill on equal durations with treadmill running group. We assessed the expression of ⊿FosB using immunohistochemistry in various brain regions, such as prefrontal cortex, striatum, nucleus accumbens, hippocampus, paraventricular nucleus of hypothalamus, amygdala, ventral tegmental area, dorsal raphe, and locus coeluerus.

Two way ANOVA revealed the significant main effects for the number of ⊿FosB expression in striatum between control and treadmill running. Multiple comparison showed that 3 days treadmill running induced a significant increase in the number of ⊿FosB positive cells in the striatum, which have important role for motor activity, compared to that in 1 day treadmill running ($P<0.05$). 5 days treadmill running also significantly increase ⊿FosB expression in striatum compared to 1 day, but not 3 days treadmill running. Two way ANOVA revealed the significant main effects for the number of ⊿FosB expression in hippocampus between control and treadmill running. The expression of ⊿FosB in hippocampus in rats performed treadmill running were significantly higher than that in control rats in all exercise duration. Treadmill running during 5 days induced a significant increase in the number of ⊿FosB positive cells in the hippocampus compared to 1 day and 3 days treadmill running.

The results of the present study showed that treadmill running enhance ⊿FosB expression in striatum and hippocampus in despite of relatively short exercise duration. The increasing levels of ⊿FosB with repeated stimulation would result in the gradual induction of significant levels of a long-lasting AP-1 complex, which is hypothesized to underlie persisting forms of neuronal plasticity in the brain. Taken together with the results of this study, it is suggested that even short term physical exercise could improve brain functions via increasing neuronal plasticity, and that ⊿FosB may play a key role in controlling physical exercise-induced neuronal plasticity in the brain. Several studies have showed that some transcription factor, other than ⊿FosB, and its target genes, such as CREB, pCREB, and NA-1, also have critical role for regulating of neuronal plasticity. These potential proteins and its target genes provide possible mechanisms of physical exercise-induced neuronal plasticity and deserve further study.

Further research on various intensity, time, and modality of physical exercise would clarify the association of physical exercise and neuronal plasticity in the brain.

P-1-8 Determination of callosal connections contributing to interaction of responses to faces

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Communication between the two cerebral hemispheres via the corpus callosum is crucial for an integrated representation of the environment. Interaction delays due to slow neuronal conduction, however, can potentially be damaging for a coherent representation. Measurements of interaction delay, therefore, are of importance for the understanding of hemispheric interaction. One way to measure delays in callosal connections is to measure the latency difference of brain activity to contra- and ipsi-laterally presented visual stimulus. Measurements of this type have been advanced using electro encephalogram (EEG), but the underlying connections have not been understood. Here we measured the latency difference of event related potential (ERP) N170 to contra- and ipsi-laterally presented face stimuli. To examine its relationship with callosal connectivity, we took diffusion weighted images (DWI) in a magnetic resonance image (MRI) scanner in the same subjects.

Twenty three normal subjects participated in this study. ERP was measured using a conventional EEG setup. Electrodes were pasted at T5 and T6 following the 10-20 method. Visual stimuli were presented on a 19-inch liquid crystal display (LCD) monitor. Each trial started with the presentation of a fixation point, and after 2 seconds, a scrambled face image was presented 10 degrees to the right or left of the fixation point. Five hundred milliseconds later, a scrambled face image was presented on the other side of the fixation point, and following another 500msec, one of the two scrambled images turned into a face stimulus. The scrambled images were presented so that the average luminance wouldn't change when the face stimulus was presented, eliminating transient luminance related responses to the face stimulus. Five hundred milliseconds later, all stimuli except the fixation point were turned off. The trial sequence was repeated 200 times, and subjects were instructed to keep their eyes on the fixation point throughout the experiment. In 5% of the trials, an apple instead of a face stimulus was presented, and the subjects were instructed to press a mouse button when they saw an apple. DWI were taken for 64 axes using a 1.5T MRI scanner (Avanto syngo, Siemens).

For each individual, we calculated the average latency difference of N170 between ipsi- and contra-laterally presented face stimuli across the two hemispheres. Average latency differences ranged from 9 to 53 msec. We next dissected the corpus callosum into 5 regions according to Hofer & Frahn (2006). Fraction anisotropy (FA) and apparent diffusion coefficient (ADC) were calculated from the DWI data around these 5 regions. We then correlated the FA or ADC with the average latency difference of N170 across subjects. We found no correlation between FA or ADC and the average latency difference of N170 in all of the 5 corpus callosum regions.

Our results show that, although we succeeded in extracting interaction delays across hemispheres, we could not find a correlate of the underlying connections around the corpus callosum. This could be because individual differences in white matter structure, presumably related to myelination, could not be detected with sufficient sensitivity using our methods. Alternatively, the interaction delays observed in our study could have arisen from a different pathway that does not involve the corpus callosum. Overall, the constraints that give rise to individual differences in interaction delay are yet to be determined.

P-1-9 Distinct motor plans enable simultaneous adaptation to conflicting force fields

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It is well-established that human subjects can rapidly adapt to novel perturbations (like visuo-motor rotations or force fields) by changing their internal model of the environment. However, subjects have great difficulty adapting the same limb movement to oppositely directed perturbations suggesting that internal models represent perturbations with respect to the limb movement states (i.e., joint angles and velocities). An outstanding issue is whether perturbations are represented with respect to the actual or planned movement of the limb. To test between these two hypotheses we used a novel experimental paradigm that dissociated between the subject's planned and actual limb movements.

Thirteen participants were asked to make reaching movements while holding the handle of a manipulandum (PHANToM Premium 1.5HF, SensAble Technologies, Woburn MA, USA). The hand position was displayed as a cursor on a horizontal screen located above their hand. The target was alternately presented at 30^{o} either clockwise (CW) or counter-clockwise (CCW) from the straight-ahead position. At first, the cursor was displayed just above the handle, but as the trial continued, its position was gradually rotated around the starting position to 30^{o} CW for the CW target and 30^{o} CCW for the CCW target. Accordingly, a subject needs to move the hand to the straight forward direction in order to move the cursor to either target. As the rotation angle increased after the baseline trials, the participants gradually adapted to the visuomotor rotation and finally moved their hands to a nearly straight-ahead direction regardless of which target appeared. Importantly, because of the gradual increment of the rotations, most of the participants were unaware of the presence of the rotation and believed they were moving their hands toward different targets. Thus, this experimental design succeeded in implicitly assigning different movement plans to nearly identical physical movements.

Next, we sought to determine whether the same neural substrate is involved in these two physically identical movements. To address this question, we further exposed the participants to two conflicting force fields; CW and CCW force fields were applied for movements toward the CW and CCW targets, respectively, in the presence of the visuomotor rotations. We predicted that different neural substrates would enable simultaneous adaptation to the conflicting force fields. Initially, the force fields deviated the hand trajectory laterally, but the deviation significantly decreased with training in both force-field conditions (Holm's test, $P < 0.05$). Participants also exhibited significant aftereffects in the catch trials in both force-field conditions (Holm's test, $P < 0.05$). However, it is possible that the slight difference in physical movement (~10^{o}) enabled simultaneous adaptation. To test this possibility, we conducted Experiment 2 with eight newly recruited participants. In this experiment, CW and CCW force fields were applied to movement toward CW and CCW targets located slightly (10^{o}) apart from each other. In this case, we did not observe any evidence of simultaneous adaptation; no significant learning or aftereffects were observed for the CW target (Holm's test, $P > 0.05$). Furthermore, the aftereffects were significantly smaller for Experiment 2 than for Experiment 1 in both force-field conditions (Holm's test, $P < 0.05$).

These results indicate that a directional difference of approximately 10° in physical motion is insufficient to enable adaptation to conflicting force fields. These results suggest that an internal model of a novel force is not necessarily learned in association with physical-movement states but, rather, in association with planned movements in visual space.

P-1-10 Establishment of a mouse model of dementia and exercise treatment

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Purpose> To establish a mouse model of dementia in order to examine whether exercise treatment decrease tau phosphorylation in neurons.

Methods> We generated a tauopathy model mice (Tg601) overexpressing the wild-type human tau (2N,4R) under CAMK-II promoter control. . We performed behavioral analysis including elevated plus maze (EPM) test for anxiety, Morris Water Maze (MWM) test for memory, string agility test and balance beam test for motor function and open field test for general activity. For western blotting, we extracted TBS-soluble and sarkosyl-insoluble fraction. To detect neurofibrillary tangles (NFTs), we performed Gallyas silver staining. We used the following antibodies: Tau5 and E1, for phosphorylation-independent antibodies and AT8, AT180 and PHF-1, for phosphorylation-dependent antibodies. We evaluated axonal dilatation with SMI-32 antibody and electron microscopy. We also evaluated the immunoreactivity of PSD95 and Drebrin as a postsynaptic marker and dendritic spines with Golgi staining. To detect hypometabolism in the brain, we performed positoron emmision tomography (PET) with [^{18}F]2-fluoro-2-deoxy-D-glucose ([^{18}F]FDG).

Results> The levels of exogenous tau expression of Tg601 was four- to eightfold higher than those of endogenous tau. The exogenous tau was expressed mainly in the forebrain but not hindbrain. Although AT8-positive and AT180-positive neurons were present in the forebrain, there were neither Gallyas-positive neurons nor neuronal cell loss. The sarcosyl-insolble fraction did not display positive tau signals. For EPM, Tg601 spent more time in the open arms at 16 months but not 6 months ($P < 0.01$). For the MWM test, Tg601 showed impaired place learning ability at 14 months ($P < 0.05$). The other behavioral tests did not show any difference. The numerous axonal dilatations were observed mainly in the prefrontal cortex. The mice developed synapse loss and glucose hypometabolism in the nucleus accumbens.

Discussion and Conclusion> We were succeeded in establishment of a mouse model of dementia (Tg601). We will investigate the protective effect of treadmill exercise on tau phosphorylation and axonal transport using Tg601.

P-1-11 The influence of time-scale changes in movement on mental images and prediction

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Introduction Some studies have demonstrated that athletes' motor skills are more developed than those of untrained individuals. By effectively using such skills, athletes can stably execute complex movements with reduced errors. In addition, as a performance-improving approach, they mentally simulate similar movements of other athletes, predicting their outcomes (Aglioti et al., 2008). These findings suggest that strengthening the ability to form mental images of others' movements and predict their consequences may be effective for performance improvement. In fact, the human brain contains mirror neurons that fire when an individual observes a movement executed by another, and recent neurophysiological and neuroimaging studies have reported the presence of a human motor mirror system providing feedback of movement simulation to the observer (Cross et al., 2006). Up to the present, however, the influence of changes in the mediating variable of the time factor of an observed movement on such stimulation has not been clarified. Therefore, this study aimed to examine the influence of time-scale changes in movement during a basketball free-throw on mental images and prediction, and differences in gaze, involved in these changes, by simultaneously conducting eye-tracking measurement.

Methods Six male basketball team members ("players"), aged 21.8±0.4, and 6 males without experience of playing basketball ("watchers"), aged 22.3±2.3, were studied. Images of 10 successful and 10 unsuccessful throws, giving a total of 20 free-throws, recorded from shooting to the peak of the throw, were randomly presented to subjects at 3 different speeds (slow, normal, and fast). The mean rates of correct predictions of the results were calculated by group. Gaze during observation was measured using a high-precision eye tracking system (Eyelink2, SRresearch) to examine rates of fixation within 3 regions (lower and upper body, and ball-tracking) of the image.

Results The correct prediction rate was significantly higher in the players than in the watchers when watching the images at normal speed ($p<0.01$, independent t-test). Analysis of the simultaneously recorded gaze data revealed that the players' fixation rate was highest in the lower body region, followed, in this order, by the upper and ball-tracking regions. In contrast, the watchers' gaze was not observed in the lower body region, and their fixation rate was higher in the ball-tracking than in the upper body region. When watching the images at slow and fast speeds, a similar tendency in the fixation rate was observed in both groups, although the players' correct prediction rates significantly decreased ($p<0.01$, paired t-test).

Discussion When watching the images at normal speed, the players' correct prediction rate was significantly higher as a result of their gaze being focused on the lower body region, demonstrating that factors essential for mental imagery, which is a process contributing to the prediction of throw results, are involved in this region. In line with this, the watchers' high fixation rate in the ball-tracking region may be explained by their tendency to predict throw results solely based on the orbit of the ball. On the other hand, the players' correct prediction rates varying among different speeds despite their similar fixation rates in all 3 regions suggest that the mediating variable of the time factor may be associated with mental imagery. Based on these results, it may be concluded that the speed of a movement, similar to that necessary for the observer to actually execute it, facilitates mental imagery and prediction of the outcome. Therefore, to strengthen the ability to form mental images of others' movements and predict outcomes, repeatedly watching recorded images at normal speed may be more effective than scrutinizing them at slow speed.

P-1-12 Evaluation of olfactory dysfunction in Parkinson's disease by using smell identification card kit

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Background: Ansari et al. (1975) first reported the olfactory dysfunction in patient with Parkinson's disease. The pathological change in the brain of the idiopathic Parkinson's disease (IPD) is characterized by a development of a Lewy bodies. The earliest lesion had appeared to the olfactory bulb and the dorsal motor nucleus of the vagus nerve before the motor symptoms such as tremor, rigidity, slowness of movement, and postural instability were developed. Since dysfunction of odor perception has been regarded as the first symptom of the Parkinson's disease, olfactory assessment may be a preclinical sign for developing Parkinson's disease.

Objective: Although many smell identification tests were developed in western countries, they are not common in Japan because their odorants are not familiar to Japanese people. In this study, we evaluated the impaired olfaction in IPD patients in Japan by using the Open Essence (OE), a smell identification test card kit, to clarify the effectiveness of this test.

Method: Twenty-nine patients with IPD (14 females aged 51-83 years with a mean age of 70.9±8.3 years and 15 males aged 51-80 years with a mean age of 67.6±8.9 years), 16 patients with other neurological diseases (ND) having no sign of odor dysfunction (9 females aged 47-85 years with a mean age of 72.7±7.1 years and 7 males aged 59-82 years with a mean age of 63.3±13.5 years) and 10 healthy controls having no olfactory complaints (5 females aged 53-78 years with a mean age of 63.8±8.6 years and 5 males aged 58-79 years with a mean age of 68.6±14.0 years) were registered to this study. Olfaction in all three groups was assessed by OE.

Result: All of the patients who enrolled to this study could accomplish the olfaction test. The OE score was significantly lower in IPD group compared with the other two groups. There was no difference in OE score between the control and ND groups. The score was not significantly different between female and male. The number of correct answers was not significantly correlated with disease duration or Brinkman Index.

Conclusion: This is the first report that OE is an appropriate test to estimate the olfactory dysfunction of Japanese IPD patients. Our results suggest that OE, the simple and suitable olfaction test, can apply to clinical use for early diagnosis of Japanese IPD.

P-2-1 The impact of the lifestyle on proteinuria and estimated glomerular filtration rate (eGFR)

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Introduction: It is shown that various unhealthy lifestyle habits (obesity, smoking, physical inactivity and heavy alcohol consumption) have influence on the development of chronic kidney disease (CKD). However, the relations between lifestyle and CKD sometimes show paradoxical results. In the epidemiologic studies, CKD is defined with estimated glomerular filtration rate (eGFR) and proteinuria. Proteinuria has been associated with development of CKD. However, some of patients with CKD have not shown proteinuria or other risks. The mechanism of the proteinuria and the low level of eGFR are still unkown. In addition, we do not completely comprehend the relations between proteinuria and eGFR.

Aim: The aim of the present study is to investigate the impact of the lifestyle on proteinuria and eGFR.

Methods: Two calculations were used during this examination. 1. "the Japanese GFR inference calculating formula" from Japanese Nephric Society : [eGFR (ml/min/ $1.73m^2$)=194×serum creatinine(mg/dl)$^{-1.094}$×age(years)$^{-0.287}$(×0.739: female)]; 2. "HbA1c (NGSP equivalent value) (%)" from Japan Diabetes Society: [HbA1c (JDS)(%) + 0.4%]; Urinalysis was performed using an auto analyzer Clinitek Atlas XL (Siemens Healthcare diagnostics k.k., Japan). The results of the urine test were interpreted as (-), (±), (1+), (2+), (3+). Results of the urine tests, "-" or "+/-" were defined as normal; others were defined as proteinuria. Participants less than eGFR 60ml/min/$1.73m^2$ (eGFR<60) were defined as the low level of eGFR. The lifestyle habits were evaluated by a questionnaire. The unhealthy lifestyle habits were defined as follows: 1. obesity (greater than body mass index 25kg/m^2), 2. current/former smoking, 3. irregular meals, 4. less than 7hours of sleep, 5. exercising of less than once weekly and 6. drinking of more than once weekly. Metabolic disorders were defined as participants who have been receiving pharmacotherapy for diabetes, hypertension, dyslipidemia and/or hyperuricemia/gout. Arteriosclerotic diseases were defined as participants who had clinical recording of cardiovascular disease and/or stroke. Renal diseases were defined as participants who had clinical recording of kidney/urinary calculus, nephritis/nephrosis, kidney cancer and/or renal insufficiency. The total of 25,493 middle-aged participants (male 74.2%/ female 25.8%) were cross-sectionally analyzed in the present study. Significant and independent predictors affecting the presence of proteinuria and the low level of eGFR were identified by multiple logistic regression models. The covariates used for the multivariate analysis were age, sex, systolic blood pressure, high-density lipoprotein cholesterol (HDLC), low-density lipoprotein cholesterol (LDLC), triglycerides (TG), HbA1c (NGSP equivalent value), uric acid (UA), the prevalence of diseases (renal diseases, metabolic disorders and arteriosclerotic diseases), lifestyle habits, and the level of eGFR or the presence of proteinuria.

Results: The significant and independent lifestyle factors associated with proteinuria were as follows: obesity (odds ratio: 1.18, 95%C.I: 1.04-1.34), current/ former smoking (odds ratio: 1.29, 95%C.I: 1.14-1.46), irregular meals (odds ratio: 1.48, 95%C.I: 1.29-1.70) and exercising less than once weekly (odds ratio: 1.23, 95%C.I: 1.09-1.38). In contrast, the significant and independent lifestyle factors associated with low level of eGFR were as follows: drinking (odds ratio: 0.75, 95%C.I: 0.68-0.83), current/ former smoking (odds ratio: 0.75, 95%C.I: 0.68-0.83) and exercising less than once weekly (odds ratio: 0.90, 95%C.I: 0.82-0.98).

Conclusion: The relationship is shown among proteinuria and some unhealthy lifestyle habits in our cross-sectional study. Lifestyle habits modification is important for preventing adverse outcomes in patients with CKD. Proteinuria should be carefully monitored for managing of CKD.

P-2-2 Preliminary evaluation of the Japanese national project: specialized health screenings and health guidance for metabolic syndrome

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Objective: The national project to reduce medical costs through the intervention program incorporating "specialized health screenings (SHS) and health guidance (SHG) for metabolic syndrome (MetS) " was begun from 2008. The purpose of this report is to show a preliminary evaluation of the national project.

Specialized health screenings and health guidance for MetS: This national project based on the new health reform law enforced in 2008. Health insurance associations must provide SHS to detect MetS subjects for whole 40-74 years olds population, and after that they provide SHG by doctors, PHNs, dieticians for people who matched Japanese MetS criteria. The national project uses the MetS criteria released in 2005 by eight Japanese academic societies. SHG has two intervention categories: "motivational support" or "active support" depends on a number of MetS risk factors. "Motivational support" includes minimum 20 minutes session of health guidance and "active support" includes 6 months follow up program must satisfy 180 points of contents. The point system strictly determined by the government for quality control of health guidance.

Methods: To evaluate the efficacy of SHG, we described 1) questionnaire survey which focus on problems of SHS of SHG at SANPO (occupational health) society in 2008, and 2) epidemiological study through SHG experience in an outsourcing health guidance company in Tokyo metropolitan area. We showed medical status of 23,092 SHG subjects, assessed the relation between MetS risks and various lifestyle factors by cross-sectional design and evaluated preliminary efficacy for body weight reduction, behaviour change stage by pre-post design.

Results: 1) Questionnaire survey (n=135) showed the problems of SHS. That were the digitization of the health screening data (44%), discontent with the national project itself (33%), and lack of visiting rate for health screening (30%). The problems of SHG were lack of man-power (44%), worry about health guidance skill (39%) and difficulty to continue six months program (36%). 2) Subjects of epidemiological study included male 16,067 (69.5%) vs female 7,025 (30.5%), 13,950 (59.0%) subjects of "motivational support" vs 9,142 (39.0%) subjects of "active support". Average age, weight, BMI, waist circumference was 58.5 years old, 70.1kg, 26.0, 91.2cm. About 4.6% of subjects have very high risk for hypertension, dislipidemia, diabetes who corresponded to the level which treatment should be urgently necessary (e.g. BP 225/136 mmHg, FBS 521mg/dl, HbA1c 14.2) or who had serious medical problem (e.g. mental health disorder, malignant disease, low eye-vision, hearing loss). The subjects with MetS were characterized by over eating, over lipid intake, lack of vegetables, late dinner, eating out, eating rapidly, skip breakfast, lack of sleep, lack of daily physical activity, but exercise at leisure hours. Preliminary evaluation by pre-post design showed mean weight reduction rate was -3.4% at "active support" vs -2.4% at "motivational support". The follow-up rate after 6 months was 85% at "active support" vs 90% at "motivational support". The rates of "Action" and "Maintenance" stage of Prochaska's transtheoretical model increased from 29.5% (pre SHG) to 70.2% (after 6 months).

Discussion: Though there were several limitations, we found some positive impact through our interventions based on the national project. Preliminary evaluation for weight reduction and behavior change were not bad, but to keep this follow-up rate we must make great effort such as many remainder phone call (maximum 47 times). We also cleared that there were persons who weren't suitable for the health guidance in the target of SHG because of very high risk of lifestyle-related diseases or another complication such as mental health disorder. For the success of the national countermeasure for MetS prevention, we must consider revising stratification system for SHG based on risk assessment, and integration of high risk & population approach (e.g. healthy cafeteria, healthy lunch box and other workplace health promotion).

P-2-3 Early development of hypertension and diabetes mellitus in the alumni of the faculty of physical education

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(Background) Life-long physical activity is believed to prevent several lifestyle-related diseases. To examine the influence of exercise and eating habits during college on lifestyle-related diseases in middle age, we surveyed male physical education (PE) and medical alumni, where a large difference in the amount of exercise was expected.

(Methods) A total of 2,485 male alumni of Juntendo University received questionnaires about their exercise and eating habits during college.

(Results) The response rate was 36.1% (896 men replied). As students, PE alumni demonstrated heavy eating and exercise habits compared with the medical alumni. In middle age, medical alumni had longer working hours, while PE alumni reported increased smoking, longer sleeping time, and more daily walking, as well as higher caloric, carbohydrate, salt and alcohol intakes. In addition, PE alumni had earlier diagnoses of hypertension (50.0-57.4 yrs vs. 53.8-57.4 yrs) and diabetes mellitus (50.5-55.0 yrs vs. 54.8-59.8 yrs) than medical alumni. Interestingly, there was no difference in exercise-induced energy expenditure between both groups of alumni.

(Discussion) Among the male Juntendo alumni of physical education, eating habits during college student age may negative influence on the lifestyle in their middle age that may correlate early development of several life related diseases.

P-2-4 Rs10906115 in *CDC123/CAMK1D* locus and rs1359790 near *SPRY2* are associated with susceptibility to type 2 diabetes in a Japanese population

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Background Type 2 diabetes is characterized by insulin resistance and beta-cell dysfunction and affects approximately 300 million individuals worldwide. Although the precise mechanisms underlying the development and progression of type 2 diabetes have not been elucidated, it is considered that genetic factors play an important role in the pathogenesis of the disease. To date, approximately 40 of type 2 diabetes susceptibility loci have been discovered mostly through genome wide association study (GWAS). Because some of these loci have been shown to be associated with type 2 diabetes in multiple ethnic populations, these loci may be considered convincing susceptibility loci for type 2 diabetes across different ethnicities. Recently, new genetic risk variants for type 2 diabetes, rs10906115 in *CDC123/CAMK1D* and rs1359790 near *SPRY2*, have been identified by a GWAS in Chinese population (Shu *et al*. PLoS Genetics, 2010). Here, we performed a case-control association study to examine the associations of these two variants with type 2 diabetes in a Japanese population.

Methods To examine the roles of these new variants in conferring susceptibility to type 2 diabetes in the Japanese, we genotyped these single nucleotide polymorphisms (SNPs) in 3,000 type 2 diabetes cases and 3,426 controls selected from Japanese individuals registered in the BioBank Japan. The genotype of each SNP was determined by multiplex polymerase chain reaction-invader assay. To test the additive model of each SNP, the differences between the case and control groups in terms of distribution of genotype scored with additive model (0, 1, 2 for homozygous of non-effect allele, heterozygous, and homozygous of effect allele, respectively) were analyzed using a logistic regression analysis with or without adjusting sex and log-transformed body mass index (BMI). Association of these SNPs with BMI was also analyzed by multiple linear regression analysis with or without adjusting sex.

Results The risk allele of rs10906115 (A) and rs1359790 (G) were in accord with those in other East Asians populations reported by Shu et al., and both variants were significantly associated with susceptibility to type 2 diabetes in the present Japanese population (rs10906115; odds ratio [OR] = 1.12, 95% confidence interval [CI] = 1.04 – 1.20, p = 0.002, rs1359790; OR = 1.11, 95% CI = 1.03 – 1.21, p = 0.011). Adjusting for log-transformed BMI and sex did not have significant effects on the association of these SNPs with the disease (rs10906115; OR = 1.13, 95% CI = 1.05 – 1.21, p = 0.0015, rs1359790; OR = 1.11, 95% CI = 1.02 – 1.21, p = 0.018). We could not observe significant associations of the 2 SNPs with BMI (rs10906115; β = 0.001, s.e = 0.003, p = 0.74, rs1359790; β = 0.004, s.e = 0.003, p = 0.28).

Conclusion In this study, we found that rs10906115-A and rs1359790-G, those had been identified as susceptibility variants for type 2 diabetes in Chinese GWAS, were significantly associated with type 2 diabetes in the present Japanese population. The results indicate that these two variants are considered as common susceptibility variants for type 2 diabetes among East Asian populations, and the effects of these variants are likely to be independent of obesity. Further studies, including functional analysis of genes nearby these variants, will be required to understand the molecular and biological mechanisms how these genes and their polymorphisms contribute to pathophysiology of type 2 diabetes.

P-2-5 Association of single nucleotide polymorphisms within genes encoding sirtuin families with diabetic nephropathy in Japanese subjects with type 2 diabetes

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Background Diabetic nephropathy is a serious microvascular complication of diabetes, and it is a leading cause of end-stage renal disease in Western countries and in Japan. The escalating prevalence and limitation of currently available therapeutic options highlight the need for a more accurate understanding of the pathogenesis of diabetic nephropathy. Several genetic and environmental factors are likely to contribute to its development and progression, but the precise mechanism for this contribution is still unknown. Sirtuins, the silent information regulator-2 (SIR2) family, is a member of NAD-dependent deacetylases, and the sir2 gene is originally identified as a gene affecting the malting ability of yeast. Mammalian sirtuins consist of seven members, SIRT1 to SIRT7, and some of them, especially SIRT1, have been shown to play pivotal roles in the regulation of aging, longevity, or in the pathogenesis of age-related metabolic diseases, such as type 2 diabetes. The expressions of sirtuin families have been observed also in the kidneys, and recently SIRT 1 has been shown to mediate a protective role of calorie restriction in the progression of aging kidney. These observations suggest the possibility that the mammalian sirtuins are candidate for conferring susceptibility to diabetic nephropathy. To test this hypothesis, we focused on the genes encoding sirtuin families, and examined the association of single nucleotide polymorphisms within genes encoding sirtuin families with diabetic nephropathy in Japanese subjects with type 2 diabetes.

Methods We examined 52 SNPs within the genes encoding sirtuin families (11 in *SIRT1*, 7 in *SIRT2*, 14 in *SIRT3*, 7 in *SIRT4*, 9 in *SIRT5*, and 4 in *SIRT6*) in 3 independent Japanese cohorts with type 2 diabetes (study 1; 747 nephropathy cases [overt proteinuria], 557 controls [normoalbuminuria], study 2; 455 nephropathy cases [overt proteinuria] and 965 controls [normoalbuminuria], study 3; 300 nephropathy cases [end-stage renal disease] and 218 controls [normoalbuminuria]). The associations of these SNPs with diabetic nephropathy were analyzed by Cochran Armitage trend test, and results of the 3 studies were combined with a meta-analysis using the Mantel-Haenszel procedure in a fixed effect model after testing for heterogeneity.

Results We identified 4 SNPs in *SIRT1*, those were nominally associated with diabetic nephropathy (rs2236319, rs10823108, rs3818292 and rs4746720, $P < 0.05$), and subsequent haplotype analysis revealed that a haplotype consisted of the 11 SNPs within *SIRT1* locus had stronger association than those for single SNP alone ($P = 0.016$, odds ratio (OR) = 1.31, 95% confidence interval (CI) 1.05 – 1.62)). Any SNPs or haplotypes in *SIRT2 - 6* were not associated with diabetic nephropathy in the combined analysis. To validate the association of *SIRT1* with diabetic nephropathy further, we examined another 195 nephropathy cases (overt proteinuria) and 264 controls (Study 4). The results indicated that most SNPs showed consistent association with those in the original finding, and the association of the haplotype was strengthened further when the result was combined with the original data ($p = 0.0028$, OR = 1.36, 95% CI 1.11 – 1.66).

Conclusion We found that the SNPs and a haplotype within *SIRT1* were associated with susceptibility to diabetic nephropathy in four independent Japanese case-control studies. These results indicate that *SIRT1* might have some effects on conferring susceptibility to diabetic nephropathy in Japanese subjects with type 2 diabetes, and be considered as a good candidate for diabetic nephropathy, or a target to develop new drugs for the treatment of the disease.

P-2-6 Daily physical activity and cognitive function in older Japanese adults

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For the older person, a well-maintained cognitive function are often of greater importance than overall life expectancy, and it has been argued that adequate habitual physical activity makes an important contribution to realization of the goal. Several previous studies have demonstrated associations of habitual physical activity with the cognitive function, as well as with the prevention of chronic conditions such as hypertension, diabetes, and cardiovascular diseases. In most of these studies, however, physical activity was assessed using a simple questionnaire; commonly participants were asked about their moderate or vigorous activity during a typical recent week. Such subjective measurements of physical activity do not always provide accurate estimates of the volume and intensity of activity performed, particularly in older adults, where difficulties of recall are compounded by cognitive problems. Thus, the precise quantity and quality of physical activity associated with a favorable cognitive function have yet to be defined. The purpose of the present study was to examine relationships between objective accelerometer assessments of the amount and intensity of habitual physical activity and the cognitive function in older people. We hypothesized that these two activity-related variables would be associated with cognitive function scores, and specifically that the cognitive would be poorer in sedentary older individuals.

Participants were a sample of 29 men (mean 73 years) and 42 women (mean 69 years) free-living healthy Japanese adults. Criteria of recruitment were: willingness to participate and an absence of chronic disease and/or pain that could influence physical activity behavior. The participants gave written informed consent to their participation in this institutionally approved study, after the protocol, stresses, and possible risks had been fully explained to them. We measured accelerometer step counts and their metabolic equivalents (METs) for four weeks. At the end of the week and after six months, cognitive function (Mini Mental State Examination, Benton Visual Retention Test, and Task-switch reaction time test) was assessed. Physical activity was divided into three or two groups according to the month-averaged daily step count and the month-averaged daily duration of activity >3 METs: step count <7500, 7500-9999, and $\geqq$ 10000 steps/day; moderate-activity duration <30.0, and $\geqq$ 30.0 min/day. The year-averaged daily step count was significantly greater in men than in women (10383 ± 4084 vs. 8711 ± 2362 steps/day), but the Mini Mental State Examination and the Benton Visual Retention Test scores were significantly higher in women than in men (28.2 ± 1.7 vs. 29.0 ± 1.3; 6.7 ± 1.6 vs. 7.4 ± 1.3, respectively).

The year-averaged daily duration of physical activity > 3 METs and Task-switch reaction time test score did not differ significantly between sexes. Cognitive function assessed by Benton Visual Retention Test score was poorer in the lowest groups (step count <7500 steps/day) of participants with respect to step count in longitudinal data. Whereas, change of task-switch reaction time test score of participants taking moderate-activity duration $\geqq$ 30.0 min/day was significantly better in individuals with activity time <30.0 min/day after controlling for age and sex. We have suggested the importance of both the intensity and the volume of physical activity to maintain the cognitive function of older individuals.

P-2-7 Serum fatty acid synthase as a marker of esophageal neoplasia

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Background: It is a well-known fact that Anaerobiotic metabolism is accelerating in many cancer cells. Lipids seem to be undertaking the important roles of ontogeny and progression. Lipid is made from Triglyceride and fatty acid by fatty acid synthase. **Fatty acid synthase (FAS)** is overexpressed in many human cancers and is considered to be a promising target for therapy. We have reported that enzyme is overexpressed not only in tissue, but also in serum levels in many cancers. This time, we investigated: ① the expression of this candidate target in esophageal cancer, and ② the serum level of this enzyme, and considered the possibility of this enzyme for a tumor marker.

Materials and methods: ① Using immunohistochemistry, we evaluated the expression of FAS protein in **22** cases of esophageal squamous cancer, **79** cases of esophageal adenocarcinoma, and **16** cases of Barrett's esophagus with high-grade dysplasia – lesion thought to represent a pre-invasive precursor to esophageal cancer. ② By using the EIISA kit, we measured the serum level of FAS in **154** patients, who underwent surgical resection of esophageal cancer in Juntendo hospital, and **153** normal patients whose samples were provided by cardiologist, Dr. Shimada's research group. And we considered the relationship with pathological stage and clinical data.

Results: ① We discovered significantly higher levels of FAS expression in **77 %** of the squamous cancers, **96%** of the adenocarcinomas, and **94%** of the Barrett's lesions with high-grade dysplasia, when compared to levels in normal esophageal epithelium. ② The serum FAS levels were also significantly higher control(Patient's average is 13.2 ug/ml, and control is 2.3 ul/ml). There is no significant correlation with clinicopathological data.

Conclusions: Similar to several other common types of human cancer, FAS is expressed at very high levels in esophageal cancer, and in Barrett's esophagus with dysplasia, and it seems carcinogenesis parallels an increased FAS level. The serum FAS level is also expressed at significantly high levels in human esophageal carcinomas. It appears that the FAS serum level will be a tumor marker candidate.

P-2-8 dbpA mRNA up-regulated in NBNC and metabolic syndrome high risk patients with hepatocellular carcinoma

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Nonalcoholic fatty liver disease, a hepatic manifestation of the metabolic syndrome (MS) that is a newly identified risk factor in chronic liver disease and HCC. To investigated dbpA mRNA expression and promoter methylation status in NBNC and MS high risk patients with HCC. dbpA mRNA were screened in 96 paired HCC patients by qRT-PCR, The methylation status examined in 61 paired patients by using MSP. The results showed that the expression of dbpA mRNA is more significantly correlated with NBNC than that viral related patients both noncancerous and HCC specimens. And it was significantly up-regulated in the NASH origin patients. In NBNC with MS high risk patients the dbpA mRNA showed more significant than that virus related patients in noncancerous subject, While, in cancerous tissues it expression more significant with virus related MS patients. In MSP analysis showed dbpA mRNA level mostly regulated in its promoter methylation/hypomethylation status in noncancerous tissues with MS patients. In conclusion, dbpA mRNA highly expressed in NASH and MS high risk patients and it expression is partially regulated by epigenetic mechanisms such as promoter methylation/ hypomethylation. Suggested that dbpA may be one of critical factors in the carcinogenesis process in NASH and MS patients.

P-3-1 Evaluation of the effect of flavangenol on serum lipid peroxide level and development of atherosclerosis in spontaneously hyperlipidemic B6.KOR-*Apoe*^{shl} mice

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Antioxidative flavonoids are used to reduce the risk of cardiovascular diseases in humans. However, the precise mechanism for the antiatherosclerotic actions of flavonids remains to be clarified. In the present study, to elucidate the mechanism for the action of antioxidative flavonids on atherosclerosis, we investigated the effect of flavangenol, one of the most potent antioxidants currently known, on spontaneously hyperlipidemic B6.KOR-*Apoe*^{shl} mice.

Flavangenol was orally administered to B6.KOR-*Apoe*^{shl} mice *ad libitum* (6 mg flavangenol/ mouse/day). After 6 months, serum levels of lipids (total cholesterol, triglyceride, HDL-cholesterol and LDL-cholesterol) and lipid peroxide were measured, and histopatholocigal changes (lipid accumulation and inflammatory cell infiltration) in the aortic root were evaluated.

Serum levels of total cholesterol and LDL-cholesterol were markedly increased, and HDL-cholesterol level was decreased in B6.KOR-*Apoe*^{shl} mice compared with C57BL/6 mice used as a control ($p<0.001$). Among these serum lipids, only HDL-cholesterol level was significantly increased by flavangenol administration ($p<0.05$). Moreover, Oil Red O staining (lipid accumulation) was significantly increased in B6.KOR-*Apoe*^{shl} mice compared with C57BL/6 mice ($p<0.001$). Notably, flavangenol administration significantly suppressed the increase of Oil Red O staining ($p<0.01$). Similarly, inflammatory cell infiltration into the intima was significantly increased in B6.KOR-*Apoe*^{shl} mice compared with C57BL/6 mice ($p<0.01$), and flavangenol administration significantly suppressed the inflammatory cell infiltration ($p<0.01$). Importantly, flavangenol administration significantly reduced the increase of serum lipid peroxide level in B6.KOR-*Apoe*^{shl} mice ($p<0.05$).Together, these observations indicate that flavangenol, one of the most potent antioxidants, exerts the antiatherosclerotic action on spontaneously hyperlipidemic and atherosclerotic B6.KOR-*Apoe*^{shl} mice, possibly by increasing HDL-cholesterol level and reducing lipid peroxide level, thereby suppressing the lipid accumulation (formation of atherosclerotic lesion) and inflammatory cell infiltration (chronic inflammation) in the intima of the aortic root.

P-3-2 Computer-assisted retinal vessel measurement in elderly Japanese patients: correlation between right and left eyes

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Purpose: To investigate the correlation between computer-assisted retinal vessel measurements of the right and left eyes of elderly Japanese patients.

Methods: Fundus photographs were taken of both eyes of 70 patients (mean age±standard deviation: 76.3±7.7 years) at the Juntendo Tokyo Koto Geriatric Medical Center. All retinal arterioles and venules located 0.5–1.0 disc diameters from the optic disc margin were identified using a computer program. Pearson correlation (R^2) and the *t*-test for Pearson correlation coefficient were used to assess the correlation of the 140 images. The correlations of retinal vessel diameter with hypertension, diabetes, hyperlipidemia, renal dysfunction, and smoking history were also determined. The significance level was set at $P < 0.05$.

Results: Substantial correlation was found between right and left eye measurements for summary indices of retinal arterioles ($R^2 = 0.46$) and venules ($R^2 = 0.43$). Fair correlation was found in the arteriole-to-venule ratio (AVR) ($R^2 = 0.22$). Although retinal arteriole and venule diameters were moderately or fairly correlated with AVR, significant correlation was confirmed for measurements of right and left eyes on the t-test for Pearson correlation coefficient ($p<0.001$). In the group of subjects with diabetes or renal dysfunction, there was no significant correlation between right and left retinal arteriole diameters.

Conclusion: Measurements from one eye can adequately represent the retinal vessel diameters of a person. In a study with a large population, measurements of the retinal vessel diameter in one eye should be sufficient, although it may be necessary to examine both right and left eyes of patients with diabetes or renal dysfunction to evaluate individual retinal arteriole diameters.

P-3-3 Continuous exercise after cardiovascular surgery enhances cardiac recovery

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Background: Exercise is known to be a secondary prevention of the ischemic heart disease as well as attenuating remodeling for the patient with chronic heart failure. It is also reported that exercise has a beneficial effect after cardiac surgery; the beginning of exercise in the early phase of post-operative period shortens the hospital stay and accelerates social reintegration. However, the long-term effects for the cardiac function of the post-operative exercise are poorly reported. In this study, we examined the effect of the continuous exercise after cardiac surgery.

Methods: The patients with low or intermediate grade of NYHA classification (1-2) without any symptom of ischemic heart disease, or capable for exercise are registered. The patients are randomly divided into two groups: exercise (E) or non-special (NE) exercise group. The effects of exercise are assessed by physical condition, blood test or echo cardiography (e.g. heart rate: HR, blood pressure: BP, hemoglobin: Hb or brain natriuretic peptide: BNP, left ventricular ejection fraction: LVEF). The value at one week after surgery is set as baseline and the rate of change from baseline is compared between groups. The follow-up period is up to 12 months.

Results: Ten patients in each group are registered. There are no differences in the age (57.1±10.6 vs 65.2±4.8 [mean±SD], p=0.051). The patients were performed valve replacement or plasty, except for one patient in E group and three in NE group who were received coronary artery bypass grafting surgery. The value of BP, BMI, Hb or LVEF didn't show significant differences between groups in any time points. However, the rate of change of HR at 3 month post surgery is reduced in E group (93.8% vs 101.0%; E vs NE, respectively, p=0.042). The rate of change of BNP was significantly decreased in E group at 9 or 12 months after surgery (24.6% vs 53.6%, p=0.042, at 9 month and 29.1% vs 64.9%, p=0.022, at 12 month; E vs NE, respectively), although the baseline was not difference (286.0±238.1 vs 304.5±197.7, p=0.86). Furthermore the value of BNP tended to be less in E group at the all other time points in this study period, although it didn't reach to statistically significant (76.7% vs 96.7%, p=0.23, at 1 month, 33.3% vs 47.2%, p=0.19, at 3 month, 29.9% vs 49.1%, p=0.09, at 6 month; E vs NE, respectively). In addition, the classification of NYHA post surgery didn't show differences between groups.

Conclusions: The continuous exercise in post-operative period reduces HR and enhances decreasing the secretion of BNP, the marker of cardiac function, indicating the beneficial effect on the cardiac recovery after cardiac surgery.

P-3-4 Voluntary exercise ameliorates progression of atherosclerotic lesions in apolipoprotein E-deficient mice: protective role against systemic and vascular inflammation

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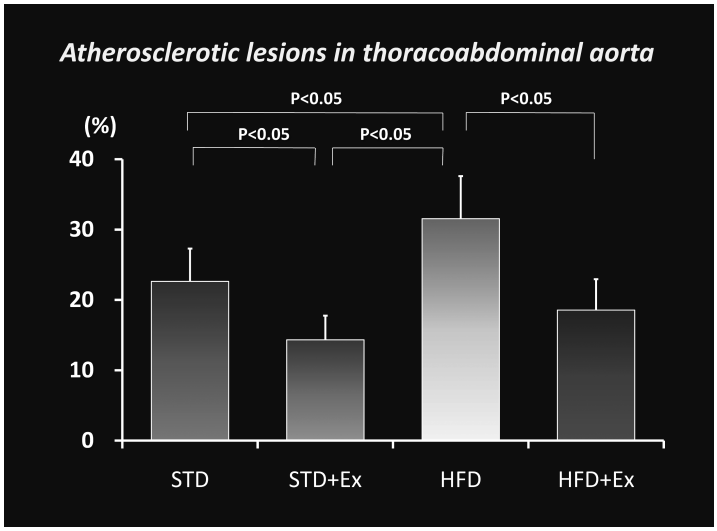
Background: Sedentary lifestyle is associated with cardiovascular disease. Previous studies have demonstrated that endurance exercise has beneficial effects on atherosclerotic diseases. However, the effects of voluntary exercise (VEx) on endothelial function, atherogenesis, and the precise mechanisms of these effects have not been clearly elucidated.

Methods: Eight-week-old male apoE-deficient mice were fed a standard diet (STD) or high-fat diet (HFD) for 10 weeks. Mice were divided into STD, HFD, STD+VEx, and HFD+VEx groups. VEx was performed using a wheel cage for 10 weeks. We assessed endothelium-dependent relaxation of isolated aorta and atherosclerotic lesions by Oil Red O-staining. We also measured lipid profiles, the weights of white adipose tissues, circulating inflammatory cytokine levels, and the levels of aortic mRNA expression for macrophages (CD68), CD4 T cells (CD4), dendritic cells (CD11c), and adiponectin receptors (AdipoR1 and AdipoR2).

Results: No significant differences in body weight changes were observed among the four groups. Total cholesterol levels were significantly higher in the HFD and HFD+VEx groups than in the STD and STD+VEx groups. However, the areas of atherosclerotic lesions in the aortic sinus and thoracic aorta were significantly lower in the HFD+VEx group than in the HFD group. In the STD+VEx and HFD+VEx groups, endothelial function was significantly preserved. Circulating levels of IL-6 and MCP-1 were significantly lower in the HFD+VEx group than in the HFD group. The aortic expression levels of CD68, CD4, and CD11c were significantly lower in both VEx groups than in the HFD group. Moreover, the weights of epididymal fat and total white adipose tissue were significantly lower and circulating adiponectin levels were significantly higher in both VEx groups than in the HFD group. Interestingly, aortic expression of AdipoR2 was higher in the VEx groups than in the HFD group.



Conclusion: VEx reduced systemic and vascular inflammation, and enhanced the levels of the anti-inflammatory adipokine adiponectin and its receptor relationship. These results suggest that VEx ameliorates the progression of endothelial dysfunction and atherosclerotic lesion formation through anti-inflammatory effects.

P-3-5 Effect of habitual cigarette smoking on maximal aerobic capacity and cardiorespiratory responses

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Introduction: Previous studies have shown that smokers' maximal aerobic capacity was lower than that of non-smokers (Cooper, 1968). The suggested mechanisms include the effect of carbon monoxide (CO) that decreases oxygen transportation due to strong affinity with hemoglobin. Other studies, however, have reported no differences in maximal aerobic capacity between smokers and non-smokers (Raven, 1974). This discrepancy may be because only few studies actually measured the boody carbon monoxide level for the smokers and non-smokers. The CO level of smokers, therefore, may have varied among studies, or even receded during the systematic experimental settings, leading to mixed results. In order to clarify the effect of CO through cigarette smoking on aerobic capacity, more intensive work is needed with the body CO levels actually being measured.

Purpose: To examine the effects of habitual cigarette smoking on body CO level, maximal aerobic capacity and cardiorespiratory responses in young men.

Methods: Twelve non-smokers and ten smokers (19-23 year-old) performed maximal exercise test using a cycle ergometer (60 rpm). The work rate was initially 10 w for the first 4 min (warm-up), and then increased by 20 w/min until volitional exhaustion. Heart rate (HR), minute ventilation (V_E), volume of oxygen consumption (VO_2), respiratory exchange ratio (RER), blood lactate (La) were measured during the exercise. End-tidal CO level (ppm) was measured prior to the exercise to identify the body CO levels.

Results: The mean CO level was significantly higher for smokers than non-smokers ($p < 0.01$, Table 1). The aerobic exercise capacity and responses were, however, not significantly different between smokers and non-smokers (Table 1).

Discussion: Previous research demonstrating reduced exercise capacity for smokers used older subjects (40-57 year-old, Raven, 1974), and other behavioral factors such as regular exercise volume were not controlled. It may be possible to assume that habitual smokers are less likely to be active, and this prolonged inactivity largely accounted for the reduced exercise capacity, although the evidence for this postulation can not be provided at present. By contrast, all the subjects in this study were involved in regular soccer training, therefore the exercise effect was considered to be negligible. As a result, habitual cigarette smoking did not affect maximal aerobic capacity and cardiorespiratory responses for young men, as compared to age and gender-matched non-smokers. Cigarette smoking or CO per se, therefore, may not have a direct influence on aerobic exercise performance.

Table 1. Subjects' Characteristics and Measured Variables

Variables	Smoker (n=10)	Non-smokers (n=12)
Age (yr.)	19.7 ± 1.4	19.9 ± 1.0
Height (cm)	168.5 ± 9.2	172.2 ± 5.0
Body mass (kg)	60.8 ± 7.5	65.1 ± 7.1
Carbon monoxide (ppm)	6.3 ± 2.9*	2.2 ± 0.9
V_E (l/min)	111.8 ± 17.2	118.9 ± 18.4
Vo_2max (ml/kg/min)	50.05 ± 4.47	51.14 ± 4.09
Power at Vo_2max (w)	292.6 ± 39.9	282.3 ± 37.8
HRmax (beats/min)	189.1 ± 7.8	185.1 ± 8.2
Peak La (mmol/L)	12.6 ± 1.7	12.4 ± 1.1
RER	1.18 ± 0.05	1.20 ± 0.03
Smoking history (yr.)	1.9 ± 0.9	-
Pack・Year	1.5 ± 0.7	-

Vales are presented as mean ± SD.

*$P < 0.01$ significantly different from non-smokers

P-3-6 Effects of voluntary exercise on viability and prognosis of DCM model mice

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Background: A population-based follow-up study suggests that more amount of exercise is related to lower risk of sudden cardiac death (SCD) in a population of men between the age of 42-60 years (Jari A. Laukkanen et. al. JACC 2010). Furthermore, it has been reported that moderate amount of exercise reduces the rate of hospitalization and improves quality of life in patients with HF (Edward J.Davies et al. European Journal of Heart Failure 2010). However, effect of exercise on patients with inherited dilated cardiomyopathy (DCM), one of causes of HF, has not been clear. DCM is characterized by ventricular dilatation and contractile dysfunction, and often associated with progressive HF and SCD. It is not well known how HF develops in carriers of DCM mutations before onset of the symptoms. We have been studying the mechanism of lethal arrhythmia using a knock-in mouse model of DCM based on human inherited DCM with a mutation of K210 (DK210) in the cardiac troponin T (TNNT2) gene, which decreases Ca^{2+} sensitivity of myofilaments (Du et al. Circ Res 2007). The present investigation had two aims: first, to use voluntary exercise as a tool for knowing their HF status in live DCM mice, and second, to evaluate the possible benefits of voluntary exercise to DCM.

Methods: Homozygous DK210 and wild type (WT) mice at various ages were housed with a running wheel (diameter = 12 cm) and daily voluntary running activity was recorded. Heart, lung and body weights were determined to assess status of cardiac dilation and congestive HF. Gene expression of various ion channels were quantified by real time PCR analysis. To assess effects of exercise, we compared mice that continued exercise over 30 days with those housed without running wheel.

Results and discussion: Homozygous DCM mice died with t1/2 of 70 days (Du et al. Circ Res 2007) and showed down-regulation in multiple types of K^+ channels and accessory subunits (Suzuki et al. IUPS 2009) as reported previously. WT and homozygous DCM mice gradually learned to run using the running wheel within a week, and continued almost constant amounts of voluntary exercise of more than 10000 rounds per day. However, at some point of their lives, some DCM mice showed decreased running activity, finally almost stopped running, and died. Other DCM mice died suddenly while keeping running activities. DCM mice with decreased running activity had heavier lung weight than WT, suggesting that these mice developed congestive HF. On the contrary, DCM mice with high running activity showed normal lung weight/ body weight ratio and no sign of congestive heart failure. These results suggest running wheel is a good tool for detecting HF sign. We also found that voluntary exercise significantly prolong survival rate of DCM mice. The average lifespan of the DCM mice who continued running exercise was about 20 days longer than that without exercise. Moreover, extents of ion channel remodeling were different between DCM mice with and without exercise. Voluntary exercise appears to be beneficial in DCM mice.

P-3-7 Relationship between blood flow velocity and blood pressure during static handgrip exercise in elderly women

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Purpose: Forearm muscle work capacity, estimated as the load from which blood pressure began to increase markedly due to metabolic or circulatory changes, decreased with age (Kagaya et al. 2001). Our previous study (Shimizu et al. 2005) revealed that the peripheral vessel structure and flow characteristics changed with age in elderly. The purpose of this study was to determine a relationship between changes in blood pressure during exercise with increasing load and blood velocity in the common carotid artery and brachial artery in elderly women.

Methods: One hundred forty three healthy females (-65yrs; Gn=66, 65-75yrs; n=64, 75yrs-; n=13) participated in the study after giving their informed consents. They performed 30-s static handgrip exercise in supine position with right hand. The exercise was repeated at 30-s intervals with increasing load by 2kgw until exhaustion. Diameter and blood flow velocity of the common carotid artery and brachial artery, and intima-media thickness of carotid artery (carotid IMT) at rest were measured using B-mode and Doppler ultrasound method (HP8500GP, USA). Blood flow was calculated from these two parameters. Blood pressure was monitored continuously on the finger of the left hand (Finapres, Ohmeda, USA) on a beat by beat basis. Determination of the critical load for blood pressure elevationThe blood pressures were measured for the last 5 cardiac cycles during exercise at each load and were averaged for each load. Then they were plotted against the loads. Two regression equations were calculated for lower (Line1) and higher (Line2) loads, and the intersection of both lines was defined as "Critical load for blood pressure elevation" (BPcritical). Coefficients of regression line for Line l and Line 2 were expressed as Slope1 and Slope2, respectively. The difference of two coefficients was defined as [Slope2-Slope1].

Results and Discussion: Brachial artery (ba) and common carotid artery (cca) diameters became larger with age (ba: $r = 0.225$, $p<0.05$. cca: $r = 0.233$, $p<0.01$), whereas the blood flow velocities in ba and cca decreased (ba: $r = -0.307$, $p<0.01$. cca: $r = -0.349$, $p<0.001$). BPcritical also decreased significantly with advancing age ($r = -0.347$, $p<0.001$). The BPcritical (mean ± SE) were 9.0±0.4, 7.4±0.3 5.9±0.7 for the subjects under -65yrs, 65-75yrs, above 75yrs. Slope2 was significantly higher than Slope1 ($p<0.001$). The difference [Slope2-Slope1] became significantly larger with advancing age. The result indicated that the blood pressure elevation above the load of BPcritical became steeper with advancing age. Among the correlation coefficients between blood pressure and vessel parameters, only the blood flow velocity of the cca was correlated with the difference [Slope2-Slope1] ($p = 0.055$), in the subjects above 75yrs. The slower flow velocity reduces the sheer stress to the vessel endothelial cells and inhibits the vasodilation due to NO release. Therefore, the slower blood flow velocity in cca would result in greater elevation of blood pressure in elderly people. In conclusion, steeper blood pressure elevation during static exercise with increasing load in elderly could be partly explained by the structural and functional changes of blood vessels, although further study is needed on larger population of elderly people over 75yrs to clarify the relationship between blood pressure and vessel parameters.

P-3-8 Effects of a long-term pedometer-based physical activity program on atherosclerotic risk factors among older adults

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Background: Regular physical activity has been shown to be effective for preventing lifestyle-related diseases. Because quantitative increase of physical activity has been reported to improve atherosclerotic risk factors, walking is thought to be effective for preventing atherosclerosis. Given its convenience and safety, walking is a widely recommended prescription for older people. However, most of previous studies assessed the effectiveness of physical activity program on atherosclerotic risk factors at exercise facilities. For older adults who exercise at home, these methods are not always easy.

Objective: To establish a long-term pedometer-based physical activity program for older adults and study its effect on atherosclerotic risk factors among older adults

Methods: Subjects were 96 healthy middle-aged and older adults (24 men, 72 women, mean age: 65.3±9.1 years; mean body mass index [BMI]: 24.3±3.0 kg/m^2) in S city in Hokkaido, Japan. Each subject was provided a pedometer (Walking style HJ-720IT, Omron Healthcare Co. Ltd., Kyoto, Japan) and was instructed to walk everyday during the study. Each subject was instructed to walk with a goal of steps per day. Further, to motivate subjects, newsletters were delivered every four weeks. Anthropometrics, resting blood pressure and brachial-ankle pulse wave velocity (baPWV) were measured at baseline (week 0) and week 16. baPWV was measured at rest using a automatic oscillometric device (form PWV/ABI; Omron Colin Co. Ltd., Tokyo, Japan).

Results: The mean steps/day at baseline was 9,404.0±3,401.5 steps. The average steps/day during the study (17 weeks) was 10,677.7±3,981.0 steps and was significantly higher than baseline (increase of 2,091.7±3,281.9 steps, $p<0.001$). Mean body weight (− 2.8%, $p<0.001$), BMI (− 2.8%, $p<0.001$), waist circumference (− 2.1%, $p<0.001$), hip circumference (− 3.0%, $p<0.001$), systolic blood pressure (SBP) (− 3.7%, $p<0.01$), diastolic blood pressure (DBP) (− 2.5%, $p<0.05$) and baPWV (− 2.4%, $p<0.05$) decreased significantly. In addition, it was found that the increase in steps/day was significantly correlated with a decrease in body weight ($r=-0.222$, $p<0.05$). Further, the subjects were divided into tertile according their baseline level (lower, normal and higher). Regard to DBP and PWV, the significant decrease was found in the higher group ($p<0.05$). Regard to waist circumference and SBP, the significant decrease was found in both the higher and the normal group ($p<0.05$). Therefore, while the groups with worse results at baseline tended to improve, the groups with better results did not change.

Conclusion: The long-term pedometer-based physical activity program improved atherosclerotic risk factors of older adults. These results reveal that even a simple method using pedometers and newsletters may be efficient enough to prevent lifestyle-related diseases and maintain good health for older people. Moreover, those who with higher risks at baseline improved the best and those who with lower risks at baseline maintained their lower risks. It shows that walking produced preferable arterial stiffness among healthy older people.

P-3-9 Changes of blood biomarkers for arteriosclerosis in young throwers

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<Introduction> Many studies have shown that exercise-training leads to reduce physiological risks of cardiovascular disease, such as high blood pressure, disorder of lipid metabolism, glucose tolerance. However, exercise-training also could cause cardiovascular events in some cases. Even though in young competitive athletes, excessive exercise-training has a possibility to cause cardiovascular events such as cardiac arrest. Increase in biomarkers for oxidative stress and arteriosclerosis has been proposed as possible factor for cardiovascular events. In order to reduce the events in young athletes, we tried to establish useful biomarker. Here we analyzed the effect of moderate exercise-training on blood biomarkers for oxidative stress and arteriosclerosis in young throwers.

<Methods> Participants: Twelve young male throwers (age=20.2±1.0 years old, body weight=87.0±9.9 kg, tall=175.7±6.1 cm, BMI=28.3±3.5) participated in this study. All subjects gave written informed consent. All procedures were performed with the approval of the Juntendo University Human Ethics Committee and complied with the Declaration of Helsinki. **Exercise-training:** Throwing, weightlifting and sprint exercises for 159±41.1min were performed for 3 days in moderate exercise intensity. **Nutritional study:** The amounts of foods intake per day were calculated from questionnaire responses. After calculation of foods intake per day, the energy and protein intake per day were calculated using standard tables of food composition in Japan. In this study, we did not intervene how to take meal of the participants. **Blood biomarkers:** Blood (sera and plasma) was collected before and after the 3 days training. Measured biomarkers were related to blood sugar (glucose, HbA1c), lipids (triglyceride, total cholesterol, LDL, HDL, LDL/HDL, small-dense LDL), oxidative stresses (carbonyl proteins, oxidized PC-LDL, MDA-LDL) and inflammation (high-sensitive C-reactive protein).

<Results and Discussion> After 3 days of exercise-training, level of blood glucose, triglyceride, small-dense LDL, and MDA-LDL were decreased. Effect of exercise-training to the remaining markers for oxidative stress and other biomarkers were not observed. These results suggest that exercise-training at moderate intensity does not cause increase of oxidative stress and arteriosclerosis markers in young throwers. These biomarkers might be useful to prevent overtraining and excessive exercise-caused cardiovascular event in young athletes. Analysis of the blood biomarkers in other types of young athletes is underway in our group.

P-3-10 Effective supplementation of n-3 polyunsaturated fatty acid for aerobic training

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N-3 polyunsaturated fatty acids (n3PFA) are abundantly found in fish oil and in certain vegetable oils. Because the supplementation of n3-PFA has reduced risks of hyperlipidemia, arteriosclerosis and diabetes in humans, attention has recently been focused on this category of prophylactic efficacious ingredients against diseases related with adult lifestyle habits. These beneficial effects are attributable to changes of the fatty acid constitution in cell membranes of tissues and erythrocytes, as well as to the promotion of membrane transport and blood flow that accompany increased deformability and reduced viscosity of the erythrocyte cell membrane after 3nPFA intake. All these changes improve blood rheology. In addition, improved blood rheology facilitates the promotion of peripheral oxygen transport capacity. Although supplementary n3PFA intake, such as fish oils, ecosapentaenoic acid (EPA) and/or docosahexaenoic acid (DHA), beefsteak plant-derived oil or alpha-linolenic acid, have previously been investigated, a convergent viewpoint of the outcome has yet to be established.

The purpose of this study was to investigate whether n3PFA supplementation could improve aerobic capacity in young women. Female participants (n = 37) were divided into 6 groups and underwent a 3-month intervention study: aqua-, land-, non-aerobic training groups with or without n3PFA supplementation. Either aqua- or land-aerobic exercise was executed for 40 min/session at 3 sessions a week. The physical characteristics were measured before, 1, and 3 months after intervention. Indexes of physical fitness, biochemical indexes and maximum oxygen intake (VO2max) of participants were monitored before and after intervention. DHA (and 8 other fatty acids) and the essential fatty acid (n-6/n-3) ratio in serum and erythrocyte membrane were analyzed before, during and after intervention. Groups with aqua- and land-aerobic exercise with n3PFA intake showed: i) significant reductions in body fat, ii) marked increases in lean body mass, iii) significant glyceride reductions; iv) significant DHA elevations in the serum and erythrocyte membrane; v) significantly elevated VO2max; and vi) back muscle strength without changes in other indexes on termination of intervention. Additionally, changes in the n-6/n-3 ratio in the serum and erythrocyte membrane showed significant decreases; and the VO2max and erythrocyte membrane DHA levels (%) correlated positively in groups that underwent aerobic exercise with n3PFA supplementation. The results suggest that extensive benefits may be established if aerobic exercise, especially aqua-aerobic training, is supplemented with n3PFA for health maintenance.

P-3-11 Relationship between energy expenditure estimated by doubly labeled water method and body composition, physical fitness in primary school children

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Introduction The prevalence of childhood obesity is on the rise in many developed countries, and it has reached epidemic proportions. In Japan, an epidemiological annual survey revealed that prevalence of obesity in school children aged 6-11 y is approximately doubled over the last two decades. Moreover, physical fitness tests, which was authorized by the Ministry of Education, Culture, Sports, Science and Technology in Japan from 1964, disclosed that the overall physical fitness score of children have declined past two decades. Although environmental and cultural changes may be associated with physical inactivity in daily life, the causes of the current childhood obesity and low physical fitness epidemic are not clear. The purpose of this study was to examine the relationship between energy expenditure estimated by doubly labeled water (DLW) method and body fatness, physical fitness in primary school children.

Methods This research was performed on 30 healthy Japanese children (20 boys and 10 girls) in a public elementary school. The total energy expenditure (TEE) and % body fat were measured by the DLW method over a 6-day period. The physical activity-related energy expenditure (PAEE) was calculated as (TEE × 0.90) – predicted basal metabolic rate (pBMR) using the equation of the Recommended Dietary Allowances for Japanese (Health Promotion and Nutrition Division-Health Service Bureau Ministry of Health and Welfare 1995). The physical activity level (PAL) was also calculated as TEE/pBMR. The physical fitness tests consisted of grip strength, sit up, sit-and-reach, side steps, 20-m shuttle run, 50-m sprint, standing broad jump, and throwing a softball. Scores of each test were standardized, and total score was calculated as overall physical fitness score.

Results The TEE was 2009.8 ± 268.0 kcal/day (mean ± SD), the PAEE was 558.4 ± 202.6 kcal/day and the PAL was 1.61 ± 0.18. There were no significant relations between TEE, PAEE, PAL and % body fat. In contrast, TEE per weight (TEE/wt) and PAEE per weight (PAEE/wt) was significantly negatively correlated with % body fat ($r = -0.626$, $p < 0.01$; $r = -0.417$, $p < 0.05$, respectively). Most physical fitness tests scores except for sit-and-reach test were positively correlated with TEE, TEE/wt, PAEE, PAEE/wt, and PAL. The PAEE/wt was most strongly correlated with overall physical fitness score ($r = 0.680$, $p < 0.01$).

Discussion In this study, the significant negative correlation between body fatness and energy expenditure adjusted individual body size suggests that increasing energy expenditure is important for preventing obesity. Participants who have physically active lifestyle showed high physical fitness scores. This result indicates that physical fitness tests may predict physical activity in children. These results suggested that who were physically active would be necessary for childhood health.

(1) Health Promotion and Nutrition Division-Health Service Bureau Ministry of Health and Welfare. (1995). Recommended Dietary Allowances for Japanese.

P-4-1 Determinants to create customer satisfaction at public sport facilities in Japan

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Providing a service that results in satisfied customers will generally improve profitability for any organization that operates in a consumer market (Parasuraman, Zeithaml, & Berry, 1988). This is based on the assumption that satisfied customers will be more likely to become repeated customers or to recommend the service to others (Fornell & Wernerfelt, 1987; Howat, Murray, & Crilley,1999).

A clearer understanding of how to create satisfied customers in the sport facilities context will help managers to better predict the return or repatronage of customers. Several recent studies support the dominant position that satisfaction is a consequence of service quality (Brady & Robertson, 2001; McDougall & Levesque, 2000) and this appears consistent across service contexts. Similarly, relationships between service quality through satisfaction to repurchase intentions of customers were reported by Cronin & Taylor (1992), and Patterson & Spreng (1997). The purpose of this study was to select of service quality items by exploratory factor analysis, to develop hypothetic model each type of sport facilities, and to compare with each facilities. In addition, we propose service management idea to each type of sport facilities.

Data were collected onsite from customers (n=7,792) at 25 public sports facilities located at local area in Japan. In this research, we categorized 25 investigated facilities into 7 facility types. The questionnaire incorporated measures of six components discussed in this research, “user condition”, “incidental equipment”, “exercise equipment”, “staff”, “cleanliness” and “satisfaction”. The analysis of data was performed using SPSS 16.0 and Amos 16.0. Using SPSS 16.0, data were analyzed by exploratory factor analysis. Using Amos 16.0, structural equation modeling (SEM) was employed, and this study focused on the role that value may play as a potentially significant mediating variable in the service quality to satisfaction.

Findings indicated that value appears to play an important mediating role in satisfying judgments of customers. This exploratory study was a step towards developing more comprehensive models to assist managers of sport facilities to better understand the key drivers of satisfaction and customer’s future purchase or visitation intentions.

P-4-2 Japanese adults' gender egalitarian attitude in the sports world

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The percentage of women in participating in sports has been increasing recently in Japan. 44.5% of women over 20-year old took part in sports at least once a week in 2009, which is almost identical to their counterparts, 45.3% (Cabinet Office 2009). We see similar percentages in competitive sports. The ratio of women and men in the Japan national team who participated in the 2008 Beijing Olympics was 49.9% for women and 50.1% for men (Sport Gender data book 2010). Also women now participate in sports which were traditionally recognized as men's sports such as soccer and wrestling.

Although women's participation in sports has increased dramatically, there still exists the under-representation of women in sports management and policy decision-making positions with no clear indication that this domain will be less of a male-dominant environment. For example, of those who attended as delegation staff for the Japan national team in the 2008 Beijing Olympics, women only accounted for 14.1%. Also women account for only 1% of senior executives of Japanese major sport organizations (Sport Gender data book 2010).

The International Olympic Committee has shown its concern about the imbalance of gender ratio in decision-making structures in sports worldwide and has strongly urged each country to develop policies and procedures (Women 2004) . The Japanese Ministry of Education, Culture, Sports, Science and Technology also recognized this issue, and specifically included it as a subject in their new draft policy about sports in July, 2010.

In the United States and Europe, many studies have been conducted about the gender imbalance in sport by highlighting the power among gendered structure. Researchers conclude there are many reasons why women have disadvantages in sport organizations. Some describe positions and behaviors, often connected with gender stereotypes, that make it difficult for women to break boundaries (Kanter 1977). Some attribute the reason to self-efficacy: that women set their own limit and give up attaining executive level positions because they see how difficult it is for their female colleagues to be promoted to executive positions and how difficult it is to deal with their male colleagues once they become an executive (Sartore & Cunningham 2007). A few studies conclude that only those few women who can adapt and adjust to a man-oriented culture can survive as an executive in sport organizations (Claringbould & Knopper 2007).

There are very few studies done about the gender imbalance focusing on the gendered power structure in Japan so far.

The main purpose of my study is to examine how this gender imbalance structure developed and perpetuated in sport organizations in Japan. Acker argues that much of the social and economic inequality is created in the organizations, in the daily activities of working and organizing the work. And she points out there exists four processes that can be used to describe the gendering of organization. This gendering processes are based on people's behaviors, attitudes and feelings (Acker 1990, 2003, 2006). This research is a first part of my main study, The purpose of this research is to understand the Japanese attitudes of individuals who have similar profile with the executives in sports organization in Japan. The research was conducted in May 2010 from 310 male participants in a masters football tournament in the Kanto area. The participants range from 30 to 70 years of age. I used the SESRA-S (Scale of Egalitarian Sex Role Attitude: Suzuki 1994), which is a recognized measure of comprehensive gender egalitarian attitude (Ui 2005).

P-4-3 Inbound leisure & sport tourists to Japan

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Tokyo International University[1], Juntendo University[2], University of Alberta[3]

International tourism is on the rise year by year and is estimated to reach 1 billion mark in 2010 and 1.6 billion in 2020, according to the World Tourism Organization (WTO). In the case of Japanese, a significant increase in leisure time has made it possible for the majority of the Japanese population to travel. Despite a long recession and continuous unemployment, the year 2009 saw the number of Japanese traveling abroad almost exceeded the 16 million mark, 1 million less than the year 2005 (JTB, 2009). Sport is an important attraction for many Japanese travelers. Of the 17 million, roughly 6.8 million Japanese outbound tourists were estimated to participate in some sort of sport activities in abroad, in accordance with the Japan Travel Bureau annual report. Although the Koizumi doctrine declared to increase the number of foreign tourists to Japan, a so-called inbound tourist, twice more as “Visit Japan Campaign” in 2003, inbound tourists to Japan have not increased as expected for the last ten years. In order to attract inbound tourists to Japan, it is important to provide attractive sport programs and facilities as tourism resources. After the 911-tragedy in the USA, a number of Australians and New Zealanders has chosen Japan to enjoy snow skiing and snowboarding in Hokkaido, the northern part of Japan. The number of travelers from these nations has been tripled in the last five years. Their sport destinations used to be US ski resorts or European ski resorts. This drastic change is largely related to the geographical location and other factors such as very little time difference, diverse socio-cultural tastes, fine quality of snow, and cost-effective travel expenses. The seasonal differences between the northern and southern hemisphere seem to contribute to stimulate Oceania’s needs of enjoying skiing in summer, healthy foods and avoiding jet lag, coupled by their nationality of loving outdoor sports. Since then, inbound sport tourists from these countries have increased and spread around to other regions of Japan to regain snow sports boom.

The National Tourism Promotion Basic Law has clearly positioned tourism as one of the pillars of Japanese policy in the 21st century. In the same year, the tourism nation promotion basic plan stipulated specific goals to be achieved by 2010. Some of the important features within the basic plan include ‘increasing inbound tourists,’ ‘inviting more international conferences to Japan,’ ‘more hotel accommodations occupied by domestic tourists,’ ‘stimulating expenditures by domestic tourists’ and other inbound tourists to accelerate these measures.

P-4-4 International comparison of Sport for All promotion campaigns

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Unparalleled growth of sport was observed in the second half of the twentieth century. This period was been characterized by social diffusion and the development of mass sport. Democratization – the process by which increasingly more members of a community gain access to opportunities previously to the upper class- has taken place in the area of sport. This is not to suggest that people at all levels of society have equal access to sport. A number of conditions have influenced the democratization of sport. Regardless of income and social backgrounds more and more people actively participate in an organized or unorganized sport for health enhancement. Thus, sport has been on the verge of globalising phenomena.

Sport for All movement was initiated in the late 1980s but was not perpetuated for more than a decade, due to the economic recess in post industrial nations. The industrial world has been undergoing a dramatic restructuring of its economy and has faced a number of health problems such as obesity and cardiac diseases because of sedentary lifestyle. Thus, post industrial countries like Germany and Canada have started nationwide sport promotion campaigns recently. Even the United States of America has begun national campaign to penetrate specific target groups. Therefore, the present study will compare the campaign themes and target groups as well as campaign approaches to promote health enhancement among several nations. Singapore and Canada have been very active for sport promotion and both countries have creative promotion agency.

P-4-5 Effects of the short-time coordination exercise program during school recess on agility of elementary school students

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The considerable decline of physical fitness among youngsters has become one of the most serious social problems for the last three decades in Japan. In particular, the youngsters have not developed the ability of body control, so-called coordination ability. Thus, this study attempted to verify whether the short-time coordination exercise program would be effective to improve agility of elementary school students. Sample subjects of 62 third grade students participated in this study and they were divided into two groups; an experimental group and control one. The experimental group participated in a ten-minute coordination exercise program during the 20-minute recess three times a week for four weeks. The ten-minute program, a so-called “droutability”, was developed by the researcher and aimed to improve body coordination. The program was rather short but was designed to contain a variety of enjoyable movements. Hence, it seems to be very feasible fitness program during the recess at elementary school. The subjects in both groups were asked to perform repetitive side steps prior to and one week after the four-week program. On the basis of one-way ANOVA, the experimental group showed significantly higher scores of the repetitive side steps than the control group ($F<1, 60>=8.15$, $p<.01$). The results indicated that the short-time coordination program was effective to improve the agility for the elementary school students.

P-4-6 Career transition of professional football players in Japan: 10 years after

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In July, 2010, the Ministry of Education, Culture, Sports, Science and Technology announced their draft policy about sport which includes concerns of athletes' second career. The concern for athletes' second career has become as social issue. And, the number of professional football players in Japan who had to look at their second career has increased more and more in past 16 years since J. League was formed.

Research studies about athletes' second career have increased more rapidly than the 1980's in foreign countries (McPherson, 1980 ; Schlossberg, 1981 ; Coakley, 1983 ; Chamer & Schlossberg, 1986 ; Person & Patitpas, 1990 ; Taylor& Ogilvie, 1994 ; Drahota & Eitzen, 1998 ; Conzelmann & Nagel, 2003 ; Fogarty & McGregor-Bayne, 2008 ; Joanne & Gyozo, 2009).
In Japan, the researches about top athlete's second have been increasing from the 1990's. The experimental studies using the time series method and longitudinal method are extremely limited (Toyota & Nakagomi, 1995, 2000 ; Oba & Tokunaga, 1999, 2000 ; Jodai, 1999, 2005 ; Kubota et al., 2000 ; Tsukuba University project, 2006, 2007).

Then, we conducted the experimental studies (Jodai, 1999 & Shigeno, 1999) on former professional football player in 1999.

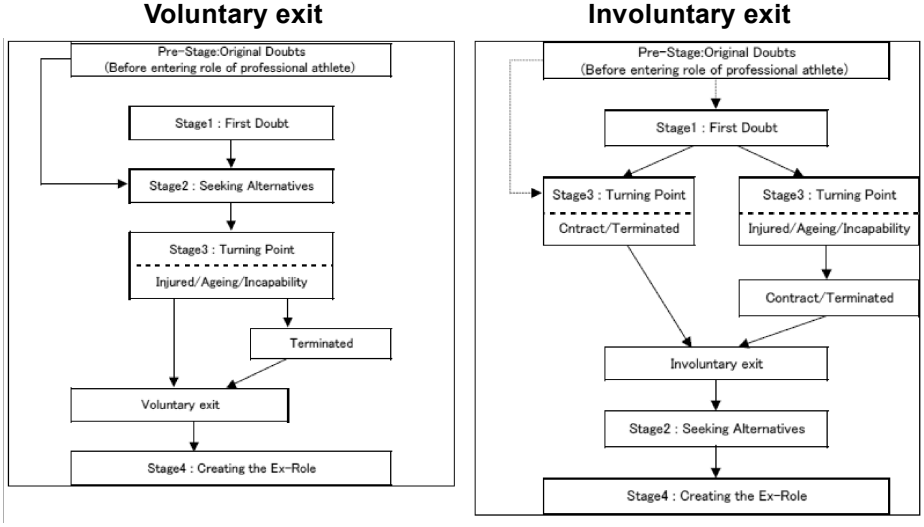
We described how the second career process of professional football players in Japan had changed over time by following the career paths of former professional football players for ten years. Based on the results, we have modified the Role-Exit Model.

Methods and Procedures Dorahota & Eitzen (1998) were front runners in this area, so this research project was a replication of Drahota at al. The research methods and procedures of this study were identical to their studies. In order to examine an ex-athlete's career transition, the researchers conducted a face to face, in-depth interview with ex-J. leaguers. On the basis of "Role Exit Theory", Drahota (1996) had an extensive research study on ex professional athletes and utilized a "Role exit model" to explain the career paths of ex-athletes. We used her model in our study.

Instruments

- Series of Face to Face in-depth interviewing: Non-structured, formal interviewing (Ave.1hour)
- Sample subject: Ex-J. leaguers (same samples who are Jodai and Shegeno's studies in 1999)
- Sampling: Purposive and snowball sampling
- Length of the project: October, 2010 – February, 2011

As a result, we found is that the process in which a person becomes professional athlete and retires and the process by which the person finds a second career are identical.



(Drahota's model modified model by Jodai, 1999)

P-4-7 Market segmentation of professional golf tour tournament in Japan: an analysis of professional golf spectators

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Sport marketing consists of activities designed to meet the needs and wants of sport consumers through exchange process. Sport marketing has developed two major thrusts. First, the marketing of sport products and services directly to consumers of sport. Second, the marketing of other consumer and industrial products or services through the use of sport promotion (Mullin, Hardy & Sutton, 2000). Sport marketing has become a very competitive, dynamic, and complex business around the world (Luna-Arocas & Tang, 2005). Sport organizations has faced with a saturated marketplace and has increased competition for consumer consumptions are compelled to alter the way they access their sport consumers (Ross, 2007). In this way, the development of the sport marketing has brought to augment the quality as well as quality of research studies the research for sports consumers.

Especially, research study of sports spectator has been done mainly in the western nations, but many studies are done now in Japan. Several researchers have been developed sports spectator scales through many studies to understand spectator characteristics, and it is reported that various factors affect spectator behaviors (Wann, 1995; Madrigal, 1995; Kahle et al., 1996; Milne & McDonald, 1999; Trail & James, 2001; Funk et al., 2001). In other studies explaining the sports spectator behavior, it is found that regardless of the physical environment, staff service influences spectator behavior (Melnick, 1993; Greenwell et al., 2002; Murray & Howat, 2002), and not only psychological factors of the sports spectator but also physical environment factors including the service quality is required (Westerbeek & Shilbury, 1999, 2003).

Past studies have shown the importance of the relations between sports managers and sports consumers, and they contribute to discovering many methods for understanding a consumer behavior in attending sport events (Funk et al., 2009). However, the sports spectator behavior were understood in reference to a standard scale developed in a previous study that did not clearly focus on the sports spectator behavior found in within the context of real life sports settings. Because characteristics of spectators differ one sport setting, to another it is important to find a relevant characteristic of the spectator for each specific sports setting (Matsuoka, 2007).

Therefore, the major purpose of this study is to ascertain the motivation profiles using the spectator behavior and the event operation instruments in a cluster analysis and to examine the possible differences in spectator characteristics with professional golf tournaments and demographic variables across different factor profiles. Whereas conventional spectator behavior, service quality and satisfaction research has typically examined behaviors of spectators attending established team sports such as football or baseball, this study is distinctive in that it attempts spectator research to an individual sport rather than a team sport and to a research without accumulation rather than a more established sport research.

Data were collected from spectators at three professional golf tour tournaments (one male tourney, two female tourneys) from the 2006 season by a quota sampling method. Using stratified sampling methodology, a data collection schedule was made up with a ratio of men to women 7 to 3 and with informants over 30-years old (The Golf Tournament Promotion Association of Japan Inc., 2003). The analysis of data was performed using SPSS 16.0 and Amos 16.0. Using SPSS 16.0, the data of this study were analyzed by using cross tabulation, a univariate analysis of variance (ANOVA), factor analysis and cluster analysis. Using Amos 16.0, confirmatory factor analysis (CFA) was employed to identify the construct validity for all latent dimensions. Results and implications were discussed in light of marketing strategies for professional golf tournament, the spectator behavior and event operation of sport consumers.

P-4-8 Comparative analysis of sport spectator motives between South Korea and Japan

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This study aimed to refine and further develop existing motivation scales in a cross-national context, and to examine differences of descriptive variables (e.g., demographics, attendance frequency) and spectator motives between South Korean and Japanese professional soccer spectators. We confirmed that the refined motivation scales we developed were valid, and that they reliably measured Korean and Japanese soccer spectators' motives. We also found that there were several differences in demographics, attendance frequency, team identification and spectator motives.

P-5-1 Adiponectin and AdipoR1 regulate PGC-1α and mitochondria by Ca^{2+} and AMPK/SIRT1

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Adiponectin is an anti-diabetic and anti-atherogenic adipokine. Plasma adiponectin levels are decreased in obesity, insulin resistance, and type 2 diabetes. Administration of adiponectin has been shown to cause glucose-lowering effects and ameliorate insulin resistance in mice. Conversely, adiponectin-deficient mice exhibit insulin resistance and diabetes. This insulin-sensitizing effect of adiponectin seems to be mediated by an increase in fatty acid oxidation by activation of AMP-activated protein kinase (AMPK) and also by peroxisome proliferator-activated receptor α (PPARα).

We previously reported the cloning of complementary DNAs encoding adiponectin receptors 1 and 2 (AdipoR1 and AdipoR2) by expression cloning. AdipoR1 is abundantly expressed in skeletal muscle and liver, whereas AdipoR2 is predominantly expressed in the liver. Both receptors are predicted to contain seven-transmembrane domains, but to be structurally and functionally distinct from G-protein-coupled receptors. Adiponectin receptors may thus be thought to comprise a new receptor family.

We previously showed using *Adipor1* and/or *Adipor2* knockout mice that AdipoR1 and AdipoR2 act as the major receptors for adiponectin *in vivo*, and have important roles in the regulation of glucose and lipid metabolism, inflammation and oxidative stress *in vivo*. Moreover, in the liver, AdipoR1 activated AMPK pathways and AdipoR2 activated PPARα pathways. Therefore, identification of the 'missing link' between adiponectin receptors and adiponectin-activated key molecules is an important next step towards our understanding of the actions of adiponectin.

Here we provide evidence that adiponectin induces extracellular Ca^{2+} influx by AdipoR1, which was necessary for subsequent activation of Ca^{2+}/calmodulin-dependent protein kinase kinase β (CaMKK β), AMPK and SIRT1, increased expression and decreased acetylation of peroxisome proliferator-activated receptor γ coactivator-1α (PGC-1α), and increased mitochondria in myocytes. Moreover, muscle-specific disruption of AdipoR1 suppressed the adiponectin-mediated increase in intracellular Ca^{2+} concentration, and decreased the activation of CaMKK, AMPK and SIRT1 by adiponectin. Suppression of AdipoR1 also resulted in decreased PGC-1α expression and deacetylation, decreased mitochondrial content and enzymes, decreased oxidative type I myofibres, and decreased oxidative stress-detoxifying enzymes in skeletal muscle, which were associated with insulin resistance and decreased exercise endurance. Decreased levels of adiponectin and AdipoR1 in obesity may have causal roles in mitochondrial dysfunction and insulin resistance seen in diabetes (*Nature 464*:1313,2010).

P-5-2 Caffeine acutely modulates signaling mechanisms of glucose transport and protein synthesis in rat skeletal muscle

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Introduction: Skeletal muscle is the major organ responsible for nutrient metabolism and whole-body insulin sensitivity. Caffeine is a plant alkaloid found in natural foods including coffee beans, tea leaves, and kola nuts, and has been implicated in the modulation of glucose and protein utilization in skeletal muscle. Although previous studies have suggested that caffeine exerts activation of insulin-independent glucose uptake (Wright et al. *Diabetes* 2005), impairment of insulin sensitivity (Greer et al. *Diabetes* 2001, Thong et al. *Diabetes* 2002) and reduction of protein synthesis (Lewis et al. *Biochem. J.* 1982), molecular mechanisms of these metabolically important events are largely unknown. In this study we investigated acute effects of caffeine on the signal transduction pathways associated with glucose and protein metabolism in skeletal muscle.

Methods: Sprague-Dawley Rats (-120g) were sacrificed by cervical dislocation without anaesthesia, and the epitrochlearis muscles were rapidly removed. Muscles were preincubated in Krebs-Ringer bicarbonate buffer (KRBP) for 40 min. The muscles were then incubated for 0-60 min with various concentration of caffeine (0-15 mM). For insulin treatment, muscles were incubated for 15 min in the absence or presence of 3 mM caffeine and were then incubated with 1 μM insulin in the absence or presence of 3 mM caffeine for 15 min. The muscles were then used for the measurement of 3-*O*-methyl glucose (3MG) transport, or immediately frozen in liquid nitrogen and subsequently analyzed for ATP, phosphocreatine (PCr), and glycogen concentrations, and isoform-specific 5'AMP-activated protein kinase (AMPK) activity, or used for Western blot analysis.

Results: (1) AMPK activation and insulin-independent glucose transport: Incubation of rat epitrochlearis muscle with KRBP containing caffeine (≥ 1 mM, ≥ 5 min) increased the phosphorylation of AMPKα Thr^{172}, an essential step for full AMPK activation, and acetyl CoA carboxylase (ACC) Ser^{79}, a downstream target of AMPK, in dose- and time-dependent manners. Incubation with 1 mM of caffeine for 15 min increased AMPKα1 activity, but not AMPKα2 activity; concentrations of ATP, PCr and glycogen were not affected. In contrast, incubation with 3 mM of caffeine activated both AMPKα1 and AMPKα2, and reduced PCr and glycogen concentrations. Both 1 mM and 3 mM of caffeine enhanced insulin-independent 3MG transport activity. (2) Inactivation of insulin signaling and protein synthesis: 3 mM of caffeine strongly inhibited insulin-stimulated 3MG transport activity in rat epitrochlearis muscle. This response was followed by reduced Akt Ser^{473} phosphorylation and glycogen synthase kinase (GSK) 3β Ser^{9} phosphorylation. Furthermore, basal and insulin-stimulated insulin receptor substrate (IRS)-1 tyrosine phosphorylation (Tyr^{612}), which plays a key role of insulin signaling, were significantly decreased. Meanwhile, basal and insulin-stimulated Ser^{307} and Ser^{789} phosphorylation of IRS-1, which are implicated in insulin resistance, were increased in the presence of caffeine. Tyrosine phosphorylation ($Tyr^{1158/62/63}$) state of insulin receptor was not affected by caffeine. In addition, caffeine clearly decreased basal and insulin-stimulated phosphorylation of p70 S6 kinase (p70S6K) Thr^{389}, a key molecule for muscle protein synthesis.

Conclusion: Our results suggest (1) that caffeine preferentially activates AMPKα1 in the absence energy deprivation and activates both AMPKα1 and AMPKα2 in the presence of energy deprivation, and that activation of AMPK leads to enhanced insulin-independent glucose transport, (2) but that caffeine impairs insulin-stimulated IRS-1/phosphoinositide 3-kinase (PI3K)/Akt signaling and insulin-stimulated glucose transport, (3) and that caffeine inhibits a signaling pathway leading to protein synthesis including Akt/mammalian target of rapamycin (mTOR)/p70S6K in skeletal muscle. We propose that caffeine modulates muscle glucose and protein metabolism by manipulating signaling mechanisms.

P-5-3 DHEA administration and exercise training improves insulin resistance in obese rats

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Introduction: Dehydroepiandrosterone (DHEA) is pre-substance of sex steroid hormone. We demonstrated that acute DHEA injection to type 1 diabetes model rats induced activation of glucose metabolism-related signaling pathway and improved hyperglycemia. Exercise leads to increases in muscular steroidogenesis-related enzymes and concomitant increases in serum and muscular DHEA levels in rats. However, the effect of DHEA administration on insulin resistance is still unclear. This study was undertaken to determine either DHEA administration or exercise training treatment alone, 6-weeks of DHEA administration combined with exercise training in obese rats would produce larger effects on steroidogenesis from DHEA to DHT in skeletal muscle and improvements in insulin sensitivity.

Methods: The rats were allowed water *ad libitum* and placed on a purified high-sucrose diet (68% of kcal from sucrose, 20% from protein, and 12% from fat) for 14 weeks. After 14 weeks of a high-sucrose diet, obese male Wistar rats were assigned randomly to one of four groups: control, DHEA administration, exercise training, and a combination of DHEA administration and exercise training (n = 10 each group). The rats then ran on the treadmill for 1 h at 25 m/min without incline 5 days/week, and DHEA (1 mg/kg body weight) dissolved in sesame oil was administered orally every day for 6 weeks. All animals continued on the high-sucrose diet during the 6-week experimental period.

Results: After 6-weeks of DHEA administration and/or exercise training, rats in the combination group weighed significantly less (combination, 562.3 ± 23.2 g; exercise, 613.9 ± 24.3 g; DHEA, 638.2 ± 26.8 g; control, 696.2 ± 25.6 g) and had lower serum insulin levels (combination, 5.64 ± 0.34 pmol/L; exercise, 6.02 ± 0.31 pmol/L; DHEA,6.02 ± 0.31 pmol/L; control, 8.94 ± 0.3 pmol/L) than rats in the other groups. Moreover, the rats treated with DHEA alone or DHEA and exercise had significantly lower abdominal fat weight (combination, 24.6 ± 4.6 mg/g body weight; exercise, 33.9 ± 7.7 mg/g body weight; DHEA, 29.6 ± 2.4 mg/g body weight; control, 38.5 ± 6.4 mg/g body weight) and fasting glucose levels (combination, 84 ± 6.5 mg/dL; exercise, 92 ± 7.8 mg/dL; DHEA, 102 ± 9.5 mg/dL; control, 148 ± 10.5 mg/dL). In addition, insulin sensitivity check index showed significant improvements in the combination group (combination, 0.347 ± 0.11; exercise, 0.337 ± 0.16%; DHEA, 0.331 ± 0.14; control, 0.308 ± 0.12). Muscular DHEA and 5ĳ-dihydrotestosterone (DHT) concentrations were significantly higher in the combination group, and closely correlated with the quantitative insulin-sensitivity check index (DHEA: r = 0.71, p < 0.01; DHT: r = 0.69, p < 0.01).

Conclusion: These results showed that the results from this study demonstrated that 6-weeks of DHEA administration combined with exercise training produced larger benefits for insulin sensitivity, body weight, and abdominal fat compared with DHEA administration or exercise training alone. Therefore, this combination of treatment modalities may provide a new therapeutic avenue for obesity and insulin resistance related to obesity.

P-5-4 Gene expression profiling in skeletal muscle related to athlete's paradox

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(Introduction) One of the main features of type 2 diabetes is insulin resistance in skeletal muscles. Previous studies demonstrated that intracellular fat accumulation in skeletal muscle correlates closely with insulin sensitivity. Intracellular substances related to intramyocellular lipid (IMCL), such as diacylglycerol and ceramide, activate signal transduction pathways and, might elicit insulin resistance in skeletal muscle. On the other hand, in endurance athletes, although IMCL level is higher than healthy subjects, their insulin sensitivity is not reduced. This phenomenon is known as the athlete's paradox and is related to chronic endurance training. However, to date, it is not clear which mechanism(s) contribute to athlete's paradox. In this study, we compared gene expression levels between sedentary and endurance athletes in this study.

(Methods) The study subjects were 10 endurance athletes (ATH) and 15 non-obese sedentary men (CON). Regular exercise was prohibited from 3 days before experiment day. Percutaneous biopsy samples were obtained from vastus lateralis muscle in the fasted state. Then, the IMCL levels in soleus muscle (SOL) and tibialis anterior muscle (TA) were measured by ^{1}H-magnetic resonance spectroscopy and peripheral insulin sensitivity (GIR) was evaluated by euglycemic hyperinsulinemic clamp (target plasma glucose level of 95 mg/dl and insulin infusion rate of 100 mU/m^2/min). Muscle gene expression profiling was performed using a DNA microarray in a subgroup of 5 subjects for both groups. RT–quantitative PCR (qPCR) was used for determination of mRNA levels of lipid metabolisms in skeletal muscle.

(Results) The IMCL level in TA was 2.5 times higher in ATH group compared with CON group (1.8 ± 1.0 vs 4.4 ± 3.4 S-fat/Cr, $P<0.01$), while IMCL in SOL was similar between the groups. On the other hand, GIR level was comparable between the groups (CON; 10.8 ± 2.1, ATH; 11.7 ± 1.4 mg/kg/min, n.s.). Thus, in ATH group, GIR is not reduced, although IMCL level in TA is higher than CON group. The Gene Ontology analysis using DNA microarray data demonstrated significant gene expression differences between the groups in Metabolic process ($p<5.82E-09$) and Primary metabolic process ($p<8.20E-10$). Pathway analysis also showed significant gene expression differences between the groups in PPARį/RXRį activation ($p<0.01$) and Citrate cycle ($P<0.05$). Gene expression levels (qPCR) related to fatty acid transport (FABP, FATP) and oxidation (PGC-1a) were significantly higher in ATH group compared with CON group.

(Cinclusion) Athlete paradox was associated with higher gene expression levels in lipid transport and oxidation. These differences may contribute to mechanism(s) of athlete's paradox.

P-5-5 Macrophages are necessary for exercise-induced enhancement of insulin sensitivity in skeletal muscle

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Type 2 diabetes and obesity are characterized by insulin resistance in skeletal muscle. It has been well demonstrated that exercise increase insulin sensitivity in skeletal muscle. However, it remains still unclear how a single bout exercise enhance subsequent insulin sensitivity. Recently, it has been reported that macrophages, at least partly, regulate insulin sensitivity in several insulin target organs. We, therefore, hypothesized that macrophages are involved in the mechanisms of exercise-induced enhancement of insulin sensitivity in skeletal muscle. To test this hypothesis, we injected saline (SAL) or clodronate liposome (CL), a macrophage suppressor, to C57BL6J mice. Then, mice were subjected to a single bout of treadmill running. Twenty-four hour after exercise, we measured ex-vivo insulin-stimulated 2-deoxy glucose (DG) uptake in skeletal muscle. We observed that a single bout exercise enhanced macrophage accumulation and insulin-stimulated 2-DG uptake in plantaris muscle in SAL group. However, CL treatment completely abolished these changes. We also observed that phosphorylation state of Akt, AS160 and AMPK were not changed by CL treatment. From these results, we conclude that macrophages are involved in the mechanisms of exercise-induced enhancement of insulin sensitivity in skeletal muscle, independent of Akt and AMPK phosphorylation states.

P-5-6 Development of the cultured-muscle cell (C2C12) contraction system by electric stimulation

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Exercise induces dynamic metabolic changes in skeletal muscles. Recently, researchers are interested in the intracellular events in skeletal muscle induced by the contraction. Cultured cell systems are frequently used to analyze intracellular events for many different type of organs. However, it is difficult to make the cultured skeletal muscle cells. To overcome the limitation, we developed a new muscle contraction system induced by electric stimulation using C2C12 muscle cell lines.

(Materials & Methods) C2C12 cells were seeded into 4-well rectangular plates and maintained in growth medium consisting of DMEM supplemented with10% FBS in the 37 °C, 5% CO_2 incubator. On reaching confluent, the medium was switched to DMEM containing 2% CS, 1% non-essential amino acid (NEAA) for differentiation (day 0). Six days after differentiation, cells were placed on the contraction system, equipped with a carbon-electrode at both ends, followed by the electric stimulation at 50V of voltage, 1Hz of frequency, 3 ms of duration, 997 ms of interval in a given time. Contraction was observed under microscopy. Cells were harvested after contraction and processed for immunoblotting to see the protein phosphorylation induced by muscle contraction. Furthermore, glucose uptake was determined by the incorporation of 2-[^{3}H] deoxyglucose for 15 min.

(Results & Discussion) C2C12 myoblasts started to fuse 2 days after differentiation induction (day 2) and formed multinucleated myotubes by day 6. About 80% of the myotubes were capable to make contraction for at least 6 hours with an electric stimulation. Immunoblotting data showed that P-38 MAP kinase and AMPK, which were known to be phosphorylated by exercise and in vitro and in situ muscle contractions, were clearly phosphorylated by the contraction (Fig. 1). Concomitant with the other contraction/exercise models, glucose uptake was also increased in our C2C12 contraction system. Lactate dehydrogenase (LDH), which was used as the indicator of plasma membrane damage or rupture, was not increased in the contracted cell medium, suggesting that cells were not damaged by electric pulse.These data demonstrated that our cell contraction system mimics the in vivo muscle contraction system. Therefore, this is the powerful tool to analyze the intracellular events induced by contraction without contamination from blood and non-skeletal muscle cells.

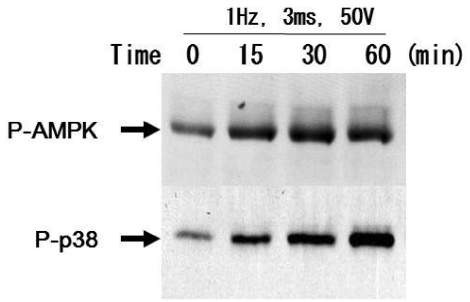

Fig. 1 Phosphorylation of AMPK and p-38 induced by electric stimulation in C2C12 cells

P-5-7 Chronic adaptations and acute hormonal responses to resistance exercise in rugby footballers and non-athlete males

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[Introduction] Resistance exercise is well-known to elicit a milieu of acute physiological responses and chronic adaptations that are important for increasing muscular strength, power and hypertrophy. Many athletes who require strength and power such as weightlifters, sprinters and footballers perform resistance exercise to improve their fitness level. Heavy resistance exercise dramatically elevates the secretion of anabolic and catabolic hormones. Furthermore, long-term resistance training may lead to changes in circulating hormonal concentrations at rest and the acute hormonal responses to resistance exercise. However, there are limited studies reporting on differences in the secretion of anabolic hormones, such as insulin like growth factor 1 (IGF-1) and testosterone between physically active and non-active subjects. In addition, it has been unclear that whether the acute hormonal responses to resistance training are different between strength-trained athletes and non-athletes.

[Purpose] The purpose of this study was to compare the resting anabolic and catabolic hormonal concentrations and the acute hormonal response to resistance exercise between strength-trained athletes and non-athletes. We hypothesized that the resting testosterone and IGF-1 concentrations would be higher in strength-trained athletes than in non-athletes, whereas the acute hormonal responses to resistance exercise would not be different between two groups.

[Methods] Eleven competitive collegiate rugby footballers (RF, 19.8±0.9 years, mean±SD) who had at least five-years experience with rugby football and eight non-athletes males (NA, 21.6±1.8 years) participated in this study. RF performed rugby football training (4 days/wk) and resistance training (2 days/wk) regularly. Body composition [fat free mass (FFM) was calculated by body weight and percentage of body fat] and one repetition maximum (RM) for bench press and lat pull down were measured. All subjects performed the acute resistance exercise test consisted of a circuit of three exercises (squat, bench press and lat pull down), repeated three sets of 10RM with a one-min rest between the sets. Blood samples were obtained before, immediately after (0 min) and 20 minuets after the test to determine the serum growth hormone (GH), free testosterone (FT), cortisol (C) and IGF-1 (resting hormonal concentration only), blood lactate (LA) and glucose (GL) concentrations

[Results] RF had a significantly greater body weight and FFM than NA ($P < 0.05$), whereas there was no significant difference in the height between RF and NA. 1RM for the bench press and lat pull down was significantly greater in RF than in NA ($P < 0.01$). Resting IGF-1 concentration was significantly higher in RF (307.3±10.46 ng/ml, mean±SE) than in NA (254.5±16.7 ng/ml) ($P < 0.05$). Concentrations of GH, FT, C, LA and GL significantly increased after the acute resistance exercise test in both groups. However, the responses of any hormones, LA and GL were not significantly different between RF and NA.

[Discussion] Despite FFM and value of 1RM were higher in RF than in NA, there were no significant differences in any hormonal responses to acute resistance exercise between two groups. These results indicate that hormonal responses to acute resistance exercise are not influenced by the training status if the relative intensity of resistance exercise is the same. However, resting IGF-1 concentration was significantly higher in RF than in NA. These results imply that elevated resting IGF-1 concentration in RF might be attributed to the high amount of FFM.

P-5-8 Effects of blood flow restriction on muscle atrophy and weakness of knee extensor and flexor muscles

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Introduction We showed in an earlier study that blood flow restriction during a 2-week immobilization and no weight bearing period prevents muscle weakness of lower extremity. However, it has not been clear if the prevention of muscle weakness associates with an attenuation of muscle atrophy. The present study aimed to examine the effects of blood flow restriction on changes in muscle strength and cross-sectional area (CSA) of knee extensor and flexor muscles induced by no weight bearing with cast immobilization of ankle joint.

Methods Ten healthy Japanese (6 males and 4 females, Age: 21.7 ± 1.2 yr, Height: 169.4 ± 10.0 cm, Weight: 62.9 ± 7.2 kg) participated in the present study. The left ankle of all subjects was immobilized by a cast for two weeks. They were also instructed to use crutches during locomotion to impose no weight bearing situation on lower extremities for the period. During the experimental period, subjects were divided into two groups as follows: a control (CON) group and a blood flow restriction (BFR) group (application of compressive force of 200 mmHg for 5 min followed by 3 min of rest, repeated 5 times in a single session, 2 sessions per day for 14d). Before and after the experimental period, knee extensor-flexor muscle strength of angular speeds of 60, 180 and 300 deg·s^{-1} under concentric contraction (CC60, 180 and 300), 60 and 180 deg·s^{-1} under eccentric contraction (EC60 and 180), and isometric contraction were measured. The peak torque of all determinations was used as an index of muscle strength. In addition, changes in CSA of thigh muscles were analyzed after the experimental period. The cross-sectional images of thigh region at 10 cm above the upper border of the patella were obtained by MRI. The images were transferred to a computer for calculation of muscle CSA.

Results The percent changes in knee extensor torques after CC300, EC60 and EC180 in the BFR group were significantly smaller than those in the CON group (CC300: -3.5 ± 4.0 % vs. -15.3 ± 7.3 %, EC60: -5.9 ± 5.6 % vs. -18.7 ± 6.7 %, EC180: -2.4 ± 8.6 % vs. -17.6 ± 8.0 %, $p < 0.05$). In knee flexor torques, a significantly smaller decrease was found after EC60 in the BFR group compared with the CON group (1.8 ± 6.5 % vs. -14.1 ± 6.7 %, $p < 0.05$). In the CSA of thigh muscles, knee extensor (PRE: 64.2 ± 12.3 cm^2 and POST: 60.7 ± 11.4 cm^2) and flexor muscles (PRE: 23.8 ± 6.7 cm^2 and 23.4 ± 6.5 cm^2) significantly decreased in the CON group ($p < 0.05$). However, in the BFR group, the CSA of only knee extensor muscles decreased significantly (PRE: 65.0 ± 11.4 cm^2 vs. POST: 62.5 ± 11.9 cm^2, $p < 0.05$).

Conclusion The blood flow restriction partially diminished the decreases in muscle torques and cross-sectional area of knee flexor muscles induced by crutch walking with cast immobilization of ankle joint. These results show that repetitive blood flow restriction is effective in attenuation of not only muscle weakness but also muscle atrophy during muscle unloading.

P-5-9 Autophagy is suppressed in soleus and plantaris muscles by resistant exercise

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Autophagy is a catabolic process involving the degradation of proteins and organelles through the lysosome. It is a major mechanism for maintenance of cellular nutrients and viability under starvation condition as well as the normal turnover of cytoplasmic component. However, the significance and regulatory mechanism of autophagy for maintenance of skeletal muscle was poorly understood. To clarify this issue, we have investigated the effect of resistant exercise on autophagy of skeletal muscles. For this purpose, mice were divided into three groups and subjected to running on a motor-driven treadmill. First group was control untrained. Second and third group were exercised at 12m/min and 16m/min, respectively, for 2 hours, with a lean of 10 degrees. All mice used in these experiments were starved for 24 hours before experiment. To investigate autophagosome formation, we examined the increase of LC3-II, a promising marker protein for autophagy and the phosphorylation of some signal transducers (S6 ribosomal protein, S6 kinase, mTOR and AKT) of mTor pathway, the activation of which suppress autophagy. Under starvation conditions, most of these signal transducers were dephosphorylated and the levels of LC3-II increased, indicating autophagy induction. However, after the treadmill exercise, these signal transducers were significantly phosphorylated and LC3-II levels decreased in most of skeletal muscles including soleus muscle and plantaris muscle. This attenuation effect was more remarkable in the second group. Thus, these data suggest that autophagy is suppressed by the appropriate exercise even under starvation conditions.

P-5-10 Effects of various types of Ca^{2+} regulation systems on differentiation and hypertrophy in skeletal muscle cells

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Aim: It is well known that an increase in cytoplasmic Ca^{2+} leads to induction of gene expression in many types of cells. In skeletal muscle cells, there are at least three types of Ca^{2+} regulation systems including excitation-contraction coupling (ECC), store-operated Ca^{2+} influx (SOC) and mechanosensitive Ca^{2+} channel (MSC). The relative contributions of these systems to muscle differentiation and hypertrophy are not well understood. In this study, we examined effects of these Ca^{2+} regulation systems on myogenic differentiation and hypertrophy in skeletal muscle cells using specific inhibitors for ECC, SOC and MSC.

Materials and Methods: C2C12 cells, a mouse myoblast cell line, were cultured on glass cover slip or silicon sheet in a growth medium (DMEM plus 10 % fetal calf serum) and differentiated in a differentiation medium (DMEM plus 2 % horse serum). Myogenic differentiation was assessed morphologically and immunohistochemically using antibody to skeletal muscle specific proteins such as RyR1 or Cav1.1. Ca^{2+} signals were optically determined in cells loaded with fluo-4 using a confocal microscope. Mechanical stress, which activates MSC, was applied by stretching cells on silicon sheet or touching cells with a tungsten needle (Fig 1). Electrical stimulation, which evokes ECC re-action, was applied by field stimulation. Inhibitors for ECC, SOC and MSC were added to experimental medium and examined the degree of myogenic differentiation and the Ca^{2+} signals.

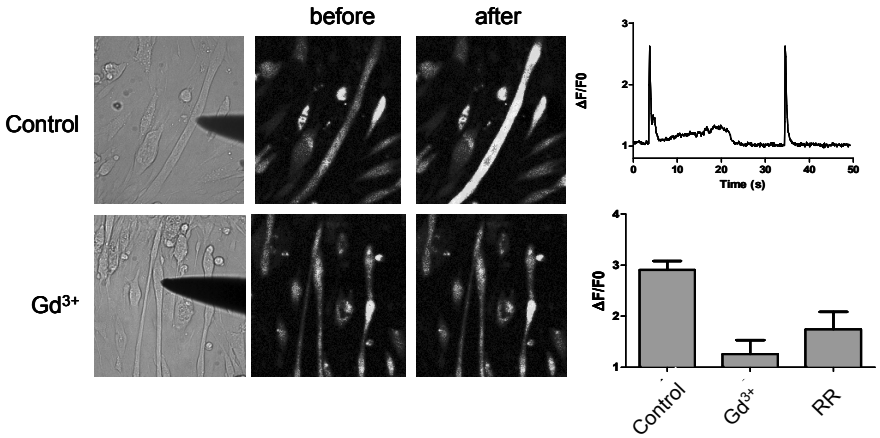

Fig. 1 Effect of mechanical stimulation on Ca^{2+} signals in differentiating C2C12 cells.

Results and Discussions: When C2C12 myoblast cells were cultured in control differentiation medium, they gradually fused each other and differentiated into myotubes within 3-7 days. In non-differentiated cells, Ca^{2+} response was induced by mechanical stress but not by electrical stimulation, whereas in differentiating cells (3-5 days in differentiation medium), mechanical and electrical stimulations both exerted Ca^{2+} responses. In differentiating cells, Gd^{3+} and ruthenium red, which suppressed MSC response but not ECC response, greatly inhibited myogenic differentiation. Nifedipine and diltiazem, inhibitors for Cav1 channels, considerably inhibited ECC response and slowed onset of MSC response. These drugs partially suppressed myogenic differentiation. 2-APB, an inhibitor for SOC, had minor effect on myogenic differentiation or Ca^{2+} responses. These results suggest that MSC is primarily responsible for supplying Ca^{2+} required for myogenic differentiation and that ECC system can modify the Ca^{2+} signaling by MSC.

P-5-11 Effects of intermittent heat stress with or without strength training on rat skeletal muscle

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BACKGRAOUND: Skeletal muscle, which is known to be highly plasticity, has a hypertrophic response to increase in muscle contractile activity. In process of muscle hypertrophy, it is necessary to increase protein synthesis compared with protein degradation in skeletal muscle. Recently, mammalian target of rapamycin (mTOR) signaling has been shown to regulate translation initiation and subsequent protein synthesis in skeletal muscle, and resistance exercise rapidly up-regulates mTOR siganlaing in Type II muscle fiber. An acute bout of heat stress also can stimulate protein synthesis and muscle hypertrophy in rats. Many studies have shown that heat stress induces heat shock proteins (HSPs) involved in protein synthesis as molecular chaperon. In addition, heat stress also stimulates mTOR signaling such as Akt and S6K1 *in vitro*. Thus, it is possible that heat stress might result in muscle hypertrophy via HSPs and mTOR signaling. However, the effects of long-term intermittent heat stress with/without mechanical stimuli on skeletal muscle mass and fiber type composition remains unclear. Therefore, the purpose of this study was to examine the effects of intermittent heat stress and/or strength training on rat skeletal muscle. We hypothesized that intermittent heat stress may affect skeletal muscle hypertrophy.

METHODS: Thirty-one Wistar male rats (17 wks) were divided into four experimental groups: sedentary control (C, n=10), heat stressed (H, n=7), strength trained (T, n=7), and strength trained and heat stressed (TH, n=7). Animals in H and TH group were exposed to environmental heat stress (41^{o}C, 60 min) on alternate days for 4 weeks. Animals in T and TH group performed squat exercise as strength training (12 repetitions $\times$ 4 sets, using 65-75% of the one-repetition maximum) for 4 weeks (4-5 days per week). After 4 weeks, the plantaris muscle in all rats was removed, weighted, immediately frozen in liquid nitrogen and stored at -80Ś C until analysis. HSP72 content and phosphorylation of mTOR and 70-kDa ribosomal protein S6 kinase ($p70^{S6K}$) were analyzed by using western blotting. Cross sectional area (CSA) and fiber type composition in deep portion of plantaris muscle was determined by using myosin ATPase stain.

RESULTS: There was no significant difference in the plantaris muscle wet weight among the four groups. Since rectum temperature of H and TH rats during heat exposure was gradually increased from 37.9 ± 0.2^{o}C to 40.6 ± 0.4^{o}C, the relative content of HSP72 in the plantaris muscle was significantly elevated in both H and TH groups compared with the C and T group ($p < 0.05$). The phosphorylation of mTOR and $p70^{S6K}$ did not change among four groups. There were no significant differences in the muscle CSA, although intermittent heat stress resulted in IIb to IIa fiber-type shift in plantaris muscle in H and TH group.

DISCUSSION: Our main finding was that intermittent heat stress on alternate days for 4 weeks induced continuously HSP72 expression without activation of mTOR signaling and increase in muscle mass and CSA, suggesting that activation of mTOR signaling with induction of HSPs is necessary for heat stress-related muscle hypertrophy. Another finding was that intermittent heat stress regulated IIb to IIa fiber type-shift. Therefore, it is possible that heat stress and/or HSPs may affect type IIa fiber. Alternatively, heat stress is known to increase cellular Ca^{2+} concentration and subsequent calcineurin activity, which is thought to enhance transcription of genes involved in slow twitch muscle. In this study, we did not determine calcineurin activity, although increase of calcineurin activity by intermittent heat stress might affect IIb to IIa fiber type shift.

CONCLUSION: Our results suggested that long-term intermittent heat stress might affect fiber-type shift rather than skeletal muscle mass with induction of HSP72.

P-5-12 Effect of heat shock protein 70 on macrophage induced inflammatory cytokines

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Urakawa reported that Heat shock protein 70 (HSP70) induced by a mild heating condition enhanced immune-competence in small animals (Urakawa et al., 2005). They claimed that hyperthermia enhances immune-competence by increasing total number of white blood cell. Macrophages, one of the white blood cells, play an important role in the immune system. Chemical or biological stimuli induce a number of cytokines to affect macrophages. The possibility of enhancing the functioning of the macrophages by means of commercial HSP70 has been shown by Dybdahl and colleagues (Dybdahl et al. 2002). However, it has been clarified that those effects of HSP70 could have been caused by lipopolysaccharide (LPS) contamination in commercial HSP70 (Gao et al. 2003). Furthermore, Shi et al. showed over expression of HSP70 inhibited the LPS-mediated expression of the pro-inflammatory cytokines TNF-α and IL-1 by either mRNA level or protein level (Shi et al. 2006). Yao reported the same result *in vivo*; namely, that HSP70 inhibited the inflammatory cytokines induced by LPS via inhibition of NF-κB (Yong-wei Yao et al. 2010). Although the immune system is indispensable for maintenance of homeostasis, over-expression of inflammatory cytokines can cause various disorders such as sepsis, rheumatism and atherosclerosis. Therefore, over-expression of HSP70 might suffocate homeostasis. Thus, it is significant to mention the inhibition mechanism on the functioning of macrophages. It is still unclear yet whether HSP70, distinguishing the LPS function, activated macrophages or not. In this study, we investigated the effects of low endotoxic HSP70 on macrophages *in-vitro*.

Murine macrophage-like J774.1 cells with HSP70 protein (St-H), LPS (St-L), both HSP70 and LPS (St-H+L) or without stimuli (control) were seeded in a 96 well culture plate and incubated at 37℃ with 5% CO_2 for 4 hours. HSP70 was added at four concentration conditions; 6, 150, 300 or 600pg/mL. In conditions of St-H and St-L, HSP70 or LPS was added after 4 hours incubation of J774.1. On the other hand, in the condition of St-H+L, LPS was added into the plate after 4 hours incubation. Then, HSP70 was added to the plate after incubation for 30 minutes. After incubation we collected the culture supernatant by centrifugation for measuring inflammatory index. Then we measured concentration of nitric oxide (NO) in the culture supernatants by means of the Greess method and tumor necrosis factor-α (TNF-α) and interleukin-6 (IL-6) in the culture supernatants by means of ELISA methods.

Induction of NO from macrophage was enhanced in low concentrations of HSP70 (6ng/mL) compared with control group but inhibited in high concentration of HSP70 (600 pg/mL). Induction of TNF-α increased with HSP70 concentration from 6 pg/mL to 600 pg/mL. On the other hand, induction of IL-6 was inhibited in high concentrations of HSP70. Regarding the condition of (St-H+L), induction of TNF-α from macrophage was inhibited by HSP70 at low concentration.The present study suggested that low endotoxic HSP70 functions to regulate the immune response so as to both increase and inhibit inflammatory cytokines from macrophage *in- vitro*.

P-6-1 Difference in the impact force and muscle activity during barefoot and shod walking

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[Introduction] The foot sustains approximately twice the body weight during the contact phase of walking. The impact force is transmitted from the plantar surface to the muscle skeletal, tendons, and joints. This force could be a risk factor for tissue injury and pain. Recently, various shoes have been developed to protect feet during walking. However, the shock-absorbing abilities of these shoes when measured in previous studies produced conflicting results. These shoes reportedly decrease impact force, consequently increasing muscle activity at the ankle joint; thus, they are important in terms of not only shoe development but also exercise prescription and disability prevention. This study aimed to investigate the shock-absorbing abilities of such shoe during walking.

[Methods] Seven volunteers (age: 23.1 ± 1.6 years; height: 1.71 ± 0.02 m; weight: 70.7 ± 9.1 kg; shoes size: 26.7 ± 0.3 cm) were instructed to walk barefoot and in standard walking shoes along a 10-m walkway at slow (3.6 km/h), medium (5.4 km/h), and fast (7.2 km/h) speeds. The ground reaction force and the electromyographic (EMG) signals were measured simultaneously during walking. The vertical ground reaction force (impact force) was recorded using a force plate at a sampling rate of 1 KHz. EMG signals at the medial gastrocnemius, lateral gastrocnemius, tibialis anterior, and soleus were recorded using a multi-telemeter system at a sampling rate of 1 KHz. The impact force and EMG signals during barefoot and shod walking at each speed were compared.

[Results and Discussion] All values are represented as “mean ± SD”. The impact force during shod walking was higher than that during barefoot walking at both slow and medium speeds (slow: shod = 1.13 ± 0.05 BW; barefoot = 1.06 ± 0.08 BW; medium: shod = 1.34 ± 0.08 BW, barefoot = 1.28 ± 0.09 BW). However, the impact force during shod walking was lower than that during barefoot walking at fast speeds (fast: shod = 1.48 ± 0.09 BW, barefoot = 1.55 ± 0.10 BW). Therefore, the shock-absorbing abilities of shoes are effective during walking at high speeds. For each walking speed, the muscle activities of the plantar flexor muscles did not differ between shod and barefoot walking. This result contradicts that of a previous study, which reported that impact force reduced when the activity of the plantar flexor muscles increased. Therefore, we suggest that plantar flexor muscles do not absorb shock during walking.

Table 1. Comparison of impact force shod and barefoot during walking

Velocity (km/h)	Impact force (BW) Barefoot	Shod	
3.6	1.08 ± 0.08	1.13 ± 0.05	**
5.4	1.28 ± 0.09	1.34 ± 0.08	*
7.2	1.55 ± 0.10	1.48 ± 0.09	P=0.07

mean ± SD

* p<0.05
** p<0.01

P-6-2 Characteristic of leg stiffness in children

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INTRODUCTION: Leg stiffness can be used to estimate the total muscle–tendon stiffness of the lower limb. It has been shown to different according to sex and training. However, little is known about leg stiffness in children, therefore this study compared leg stiffness in children and adults.

METHOD: Six adult males (AD: 1.73 ± 0.03 m, 70.4 ± 5.2 kg, 19.8 ± 1.2 yrs) and six boys (CH: 1.38 ± 0.04 m, 37.9 ± 8.5 kg, 10.0 ± 1 yr) participated in this study. They performed in-place hopping at 2.0 and 3.0 Hz on a force platform. The hopping frequency was set with a digital metronome beat. The subjects were asked to jump with as short a contact time as possible. The positions of markers on the body segment endpoints were captured by a high-speed camera at 300 Hz from the sagittal plane. The vertical component of the ground reaction force was recorded by the force plate at 1 kHz. Leg stiffness (Kleg) was calculated as the ratio of peak vertical force to the maximum displacement of center of mass (Δ COM) in the middle of the ground contact phase (Farley and Morgenroth, 1999). Five consecutive jumps, from the sixth to the tenth of 15 jumps, were used for the analysis. According to data from the ground reaction force, the actual hopping frequency, ground contact time and aerial time were determined.

RESULTS: There was no significant difference in the actual hopping frequency between the two groups (Table 1). However, the ground contact time was significantly shorter in the adults than in the children, and the flight time was significantly longer in the adults than in the children (Table 1). Leg stiffness at the two frequencies was significantly greater in the adults than in the children ($p < 0.05$).

Table 1 Comparison of each parameter in adults and children

	hopping frequency	AD	CH	
actual hopping freqency (Hz)	2.0 Hz	1.98 ± 0.04	2.00 ± 0.06	
	3.0 Hz	2.93 ± 0.04	3.00 ± 0.04	
contact time (sec)	2.0 Hz	0.165 ± 0.018	0.234 ± 0.028	*
	3.0 Hz	0.150 ± 0.018	0.185 ± 0.024	*
flight time (sec)	2.0 Hz	0.342 ± 0.022	0.267 ± 0.039	*
	3.0 Hz	0.190 ± 0.021	0.148 ± 0.026	*
Fpeak (N)	2.0 Hz	4035.1 ± 194.4	1509 ± 238.6	*
	3.0 Hz	2864.7 ± 147.9	1350 ± 253.7	*
ΔCOM (m)	2.0 Hz	0.097 ± 0.018	0.122 ± 0.008	*
	3.0 Hz	0.049 ± 0.005	0.053 ± 0.003	*
Kleg (kN/m/BW)	2.0 Hz	0.6 ± 0.2	0.8 ± 0.1	*
	3.0 Hz	0.3 ± 0.1	0.7 ± 0.1	*

mean ± SD
* ... $p<0.05$

DISCUSSION: Children had lower stiffness than adult subjects. A previous study clarified that leg stiffness was related to the ability of the muscles to produce power (Korff et al., 2009). Therefore, it is suggested that children was lower leg stiffness showed that these muscles were at a developmental stage. These findings lead us to speculate that children acquire the ability to take greater advantage of elastic energy stored in the musculotendinous system when performing maximum counter-movement jumps.

CONCLUSION: It was clarified that the characteristic of leg stiffness during jumping in children is lower than that of adults.

P-6-3 Effect of body weight, body mass index and bone metabolism maker on nutrition frequency in female long distance runner

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[Purpose] This study investigated the effect of body weight, body mass index (BMI), and bone metabolism on nutrition frequency in female long-distance runners.

[Method] Subjects were 44 female long distance runners who participated in track and field club at their companies or universities (mean age, 20.5±2.6 yr; mean height, 160.0±5.1 cm; mean weight, 47.5±4.7 kg; and mean body mass index (BMI), 18.6±1.6 kg/m2). We checked urinary type I collagen cross-linked N-telopeptide/creatinine (U-NTxCr) as a bone metabolism marker using the second urine sample. Height, weight, and BMI were measured, and all subjects answered a questionnaire about nutrition frequency for a predetermined set of 10 categories of food (1. Milk; 2. Dairy Product, 3. Small Fish; 4. Soybean Foods; 5. Meal and Fish; 6. Vegetables; 7. Fruit; 8. Soft Drinks; 9. Coffee; and 10. Alcohol). For each food group, subjects chose only one answer from five answer choices: “eat every day” to “do not eat at all.” “Eat every day” was counted as 5 points; one point was deducted as intake frequency decreased. The food group of ten items was classified into all food categories (items 1-10), the main 7 food categories (items 1-7), and food categories containing items with calcium (items 1-3). After this subclassification, the total point score was calculated.

[Result] Significant negative interrelation between nutrition frequency of all 10 foods and body weight (r=-0.325, P<0.05) and between nutrition frequency of all 10 foods and U-NTxCr (r=-0.310, P<0.01) were found. Significant negative interrelations were also found between nutrition frequency of main 7 foods and body weight (r=-0.328, P<0.05) and between nutrition frequency of main 7 foods and U-NTxCr (r=-0.482, P<0.01). Finally, a significant negative interrelation between nutrition frequency for the 3 foods with high calcium content and U-NTxCr (r=-0.520, P<0.01) was found. As with the other two subclassifications, body weight, BMI, and U-NTxCr were significantly higher in the low group than in the high group.

[Conclusion] In conclusion, these results indicate that maintaining nutrition frequency is effective in body weight, BMI and U-NTxCr, and applying well-balanced diet control bone resorption.

Table1.Interrelation of nutrition frequency, body weight body mass index and U-NTxCr

	all food categories	the main 7 food categories	food categories containing items with calcium
Body Weight	−0.325 *	−0.327 *	−0.280
Body Mass Index	−0.253	−0.284	−0.295
U-NTxCr	−0.310 *	−0.482 **	−0.520 **

** p＜0.01
* p＜0.05

P-6-4 Influence of outdoor sports experience on bone mineralization in female athletes

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Introduction

Increased of bone mass (i.e., peak bone mass; PBM) in adolescence is associated with fewer osteoporotic fractures in later life (Borer, 2005), and the PBM is related to sun light exposure, which produces vitamin D (Macdonald et al., 2008), and weight-bearing physical activities such as jumping movement (Creighton et al., 2001).

Furthermore, Heinonen et al, (2000) reported that, in females, the exercise before menarche accelerates bone metabolism and increases PBM. These reports suggest that outdoor weight-bearing sports before menarche is effective in increasing PBM in females. The present study investigated the effect of training environment (outdoor or indoor) and the timing of athletic events (before and after menarche) on bone metabolism (bone turnover markers) and bone mineralization.

Methods

Sixty-eight college female athletes aged 18-22 years (nineteen volleyball players, and forty-nine lacrosse players) participated. They were asked to report their physical activities after age 10 and their timing of menarche in the questionnaire.

We focused of three markers of bone metabolism, bone alkaline phosphatase (BAP), type I collagen cross-linked N-telopeptide (NTx) and 25 hydroxyvitamin D [25(OH)D]. Each marker is an index of bone formation, bone resorption and calcium absorption. We also measured calciotropic hormone (i.e., intact parathyroid hormone; PTH) as an index of bone mineralization.

Results & Discussion

Markers of bone metabolism (BAP and NTx) were not different between lacrosse and volleyball players (t-test, $p>0.05$). However, 25(OH)D was higher in lacrosse players (18.8±4.9ng/mL) than in volleyball players (14.1±3.0ng/mL) (t-test, $p<0.001$), while intact PTH was higher in volleyball players (37.4±13.3pg/mL) than in lacrosse players (31.6±8.0pg/mL) (t-test, $p<0.05$). Thus bone mineralization, which indicates bone quality, differed between lacrosse and volleyball players, even though total bone metabolism (bone formation and bone resorption) was not different between the two groups.

We also analyzed the influence of training environment before menarche on bone metabolism and bone mineralization in lacrosse players, because their sports experiences (outdoor and indoor sports) before menarche varied. 25(OH)D was significantly higher in those playing outdoor sports (21.5±4.1ng/mL) than indoor sports (17.7±4.8ng/mL) (t-test, $p<0.05$) (Fig.1). Thus, bone mineralization was enhanced in those playing outdoor sports before menarche.

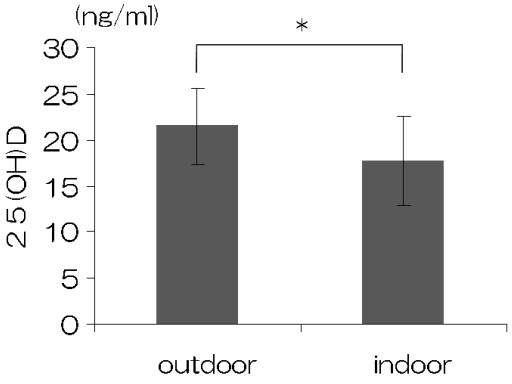

Fig.1 Difference of 25(OH)D between outdoor and indoor sports experiences before menarche. Small vertical lines show the standard deviations of means. *; $p<0.05$

Conclusion

Our results suggest that the athletic events before menarche may determine bone mineralization of adult female athletes, and that outdoor sports before menarche is more effective in enhancing of bone mineralization.

P-6-5 Characteristics of the patients with knee osteoarthritis improving their symptoms by home exercise detected by the cartilage degradation marker

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[Objective] A home exercise therapy is a basic and established conservative treatment in knee osteoarthritis (OA). This method can improve the symptoms of patient with not only primary stage but also end stage knee OA. However, this method is not effective universally and permanently. The continuity of home exercise of the patients with radiographic severe knee OA and older patients with knee OA have shown to be decreased in comparison to that of those with less severe and younger patients. However, whether a cartilage metabolism affects the efficacy of home exercise therapy has not yet examined. In this study, we examined whether there is a relationship between the cartilage metabolism evaluated by urinary levels of crosslinked C-telopeptides of Type II collagen (uCTX-II) levels and the efficacy of home exercise.

[Methods] Forty eight women (69.7 years of age, K/L grade 1: 4, 2:12. 3:13, 4:19) were enrolled in this study. They performed the therapeutic home exercise for 6 months. We evaluated patients baseline information, pain VAS score, the Japanese Knee Osteoarthritis Measure (JKOM), weight-bearing antero-posterior knee radiographs and urinary CTX-II before and after six months of treatment. The OMERACT-OARSI response criteria were used to evaluate the treatment effect for knee OA.

[Results] Twenty-two of 48 patients improved their symptom, while remaining twenty-six did not improve. No significant differences of the age, BMI and radiographic severity of OA of the patients with symptom improvement were observed in comparison to those without symptom improvement. The patients with decreasing uCTX-II (23 patients) after the treatment showed significantly higher rate of the symptom improvement than those increasing uCTX-II (18 patients) ($p<0.05$).

[Conclusion] The mechanisms for the effect of home exercise are still unclear. However, as the effect of home exercise can be recognized much earlier than the muscle power strengthening, the home exercise may have another role in addition to the muscle power strengthening. It still remained unclear whether the home exercise may affect cartilage metabolism. However, based on this result, the cartilage metabolism evaluated by urinary CTX-II may play some role for the effect of home exercise for the knee OA patients.

P-6-6 Sequential changes in cervical spine alignment in collegiate American football athletes

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Purpose: Changes in cervical spine alignment are known to occur as a result of continuing participation in American football (hereinafter “football”). However, the majority of studies have focused on changes over comparatively long time periods, measured in years. The present study was conducted with the purpose of examining changes in cervical spine alignment over a short time period.

Subjects and Methods: Subjects were 10 newly matriculating student football athletes at College A. Five subjects had prior football experience during high school, and 5 did not. Radiographic images of the head and neck area of the subjects were taken at 3-month intervals: in April before the start of contact practice; in July after the conclusion of the spring season; and in October during the fall season. Lateral images of the central part of the cervical spine in upright orientation were taken from a distance of 1.2 m. To evaluate cervical spine curvature, a curvature index was calculated using Ishihara’s methodology. The methodology of Kamada et al. was also employed for morphological classification. To evaluate spinal canal stenosis, the Pavlov ratio was calculated from the second cervical vertebrae through the seventh cervical vertebrae, and changes in each evaluation item were compared. One-way analysis of variance was used for statistical analysis, and a risk ratio of <5% was considered to indicate a significant difference.

Results: No significant changes in the curvature index or intervertebral distances between the third and sixth cervical vertebrae were identified. However, in terms of morphological classification, changes were recognized in 3 subjects (30.0%). In terms of the nature of the changes, 1 subject showed a change from lordosis (secondary curvature) to an S-shape, 1 subject showed a change from S-shape to lordosis, and 1 subject showed a change from kyphosis (primary curvature) to an S-shape. With regard to the Pavlov ratio, no significant differences were detected in individual vertebrae from the second cervical vertebra through to the seventh cervical vertebra. However, 4 subjects (40.0%) showed a change of £0.8 (Pavlov ratio) from a normal value, indicative of spinal canal stenosis. Three of these individuals also showed deviation from cervical spine lordosis.

Discussion: These results indicate that continued engagement in football causes changes in cervical spine alignment within a comparatively short period of time. Furthermore, the findings suggest that deviation of cervical spine alignment from lordosis may be a risk factor for developing spinal canal stenosis. Based on these results, meticulous and early assessment of changes in cervical spine alignment through regular medical check-ups may be warranted to prevent traumatic injuries to the neck from football.

P-6-7 Effect of dynamic balance training using the caster board on postural control for female university students

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Purpose: Postural stability is important for general motor development and performance of daily life activities. Recently, numerous types of games and tools have emerged that are designed to promote postural balance training, including the caster boards. The caster board is a two-wheeled, self-propelled vehicle that closely resembles a skateboard, but its maneuver is more similar to snowboarding or surfing than skateboarding. Caster boards have been frequently used by professional snowboarders as part of their training to improve active balance. Current research suggests that caster boarding is an effective exercise to train balance in athletes of all ages. However, there is no clear evidence regarding the effectiveness of caster board training in improving balance ability. The purpose of this study was to determine the effect of caster board exercise on postural balance.

Method: Nine untrained female subjects (age: 22±2 yrs, height: 159.2±5.5 cm, weight: 56.1±3.3 kg) participated in a one-week, minimum 20 min/day balance training program with the caster boards. The stabilometer (Active Balancer EAB-100, Sakai Medical Co, Japan) was used to quantify the center of gravity (COG) excursion in static balance before and active balance training by measuring the total shift in the length of center of gravity (LNG), LNG per second (LNG/T), and LNG per enveloped area (LNG/EA) based on maximal COG excursion, for 30 seconds with eyes open and closed in the standard Romberg position. Next, to evaluate active balance, subjects placed their pivot foot (dominant leg) on the Active Balancer and their non-pivot foot apart in parallel with hands on their waist. Subjects were instructed to displace their COG in 8 directions (anterior/posterior, medial/lateral, and 45 degrees between with the x- and y- axes) without lifting their feet and the maximal COG excursion in each direction was measured. With 75% of the maximal COG excursion as the target distance, subjects were asked to swiftly shift their COG within the target distance as displayed on the monitor. Subsequently, subjects maintained their COG in the new position for 2 seconds and the time to reach this distance was recorded. Instructions for reaching the target distance in the 8 directions were randomly varied. Finally, subjects performed the step test to evaluate their dynamic balance. While stabilizing the pivot foot on the Active Balancer, subjects moved their non-pivot, weight-bearing foot to the specified, numbered area on the monitor and maintained the position for 2 seconds. When the next target area was indicated, subjects moved their non-pivot foot accordingly.

Results: There were no significant training effects on LNG, LNG/T and LNG/EA with eyes open or closed. However, a significant training effect in active balance was noted, as indicated by the greater maximal reaching COG excursion in anterior and left-lateral directions than pre-training values ($p<0.05$). In addition, the time to reach the target distance was significantly reduced after balance training ($p<0.05$).

Conclusion: Our findings suggest that balance training with caster boards improves active balance but not static balance.

P-6-8 Detection of BACE1-mediated activation of neuregulin 1-erbB signaling using a cleavage site specific antibody

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Neuregulin 1 (NRG1) was originally discovered as an acetylcholine receptor-inducing activity in the formation of the neuromuscular junction in skeletal muscle. NRG1-mediated cell communication is critical in the central and peripheral nervous system, neuromuscular system, heart, and others. NRG1 is a family of trophic factors that contain an epidermal growth factor (EGF)-like domain in the extracellular region. By the use of multiple transcription sites and by alternative splicing, a variety of isoforms are generated from nrg1 gene. Some of them are membrane anchored (e.g., type III) and some are released (e.g., type I) upon cleavage of the extracellular domain. In both cases, shedding of NRG1 at the juxtamembrane region is thought to be essential for the activation of erbB family receptor tyrosine kinases in a juxtacrine or paracrine fashion. This ectodomain shedding is performed by membrane-bound proteases, a disintegrin and metalloprotease (ADAM) or beta-site amyloid precursor protein cleaving enzyme 1 (BACE1), at different cleavage sites. In order to understand regulatory mechanisms of NRG1-erbB signaling, it is critical to detect protease-specific cleavage products of NRG1. Therefore, we tried to prepare an antibody that specifically recognizes BACE1-cleaved C-terminal end of NRG1 ectodomain. Based on the results of in vitro digestion of a peptide encompassing the juxtamembrane region of NRG1 by recombinant BACE1, we synthesized a short peptide corresponding to the BACE1-cleaved end and immunized rabbits with it. The specificity of the prepared antibody was determined by ELISA and western blot with recombinant NRG1 proteins expressed in E. coli. Then we assessed the antibody in cultured cells transduced with cDNA encoding NRG1 in combination with activators or inhibitors of the proteases. According to the series of the assays, we concluded that the prepared antibody specifically recognizes the BACE1-cleaved end of NRG1 in cells and functions in ELISA, western blot, immunoprecipitation and immunofluorescent staining. The antibody would be useful to detect activation of erbB signaling through BACE1-mediated NRG1 cleavage in intercellular communication.

P-6-9 Anabolic action of PTH signaling on bone activated expression of a clock gene, Per-1

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Physical exercise requires and activates formation of healthy bone via interaction with anabolic action of hormones such as PTH. However, how such anabolic action affects bone to increase its mass and the mechanism underlying such activity is not fully understood. PTH is the only anabolic drug and affects the metabolism of bone via complex pathways. These days Per-1, which is one of the clock genes and is known to regulate circadian rhythm, is suspected to be affected by the physical exercise. Parathyroid hormone has been known to modulate physical force related signals in the body and could affect such clock gene expression but no information was available. Here, we examined the role of PTH signaling in the regulation of clock genes by using transgenic mouse system. We used either PTH injection or osteoblast specific expression of constitutively active PTH receptor established by using type I collagen promoter. Such PTH signaling in osteblasts activates Per-1 gene expression in bone in the animals injected with PTH intermittently. In addition, transgenic mice containing constitutively active PTH receptor also enhanced Per-1 gene expression in vivo. We also examined whether Per-1 expression is altering PTH-signaling-induced CRE dependent transcription. We found that Per-1 is required for caPPR dependent enhancement of CRE induced transcription montere based on luciferase assay system. As PTH activates Per-1 expression and Per-1 per se is necessary for PTH dependent gene transcription, these molecular events are forming a positive feed back loop in the anabolic action of PTH signaling in bone. These data indicated that PTH singling in osteoblasts requires the presence of Per-1 for its anabolic action in bone at least in part through the regulation of transcriptional events.