sportology

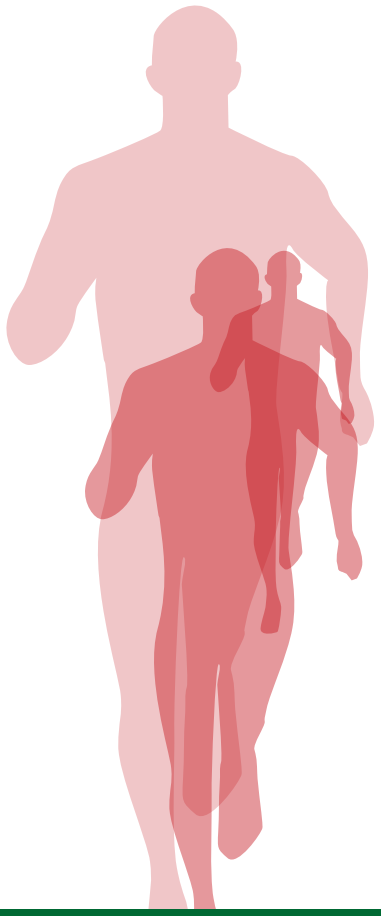
PROGRAM & ABSTRACTS

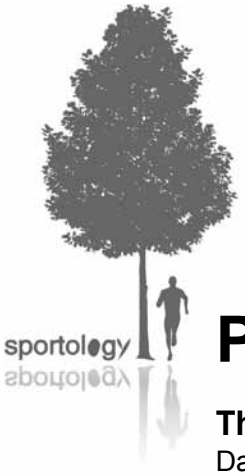
The 2nd Congress, International Academy of Sportology

Date: September 12, 2015

Venue: ARIYAMA NOBORU Memorial Hall, Juntendo University

Chairman: KAWAMORI Ryuzo
(Director, Sportology Center, Juntendo University)





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(Director, Sportology Center, Juntendo University)

CONTENTS

WELCOME MESSAGE

The 2nd Congress, International Academy of Sportology will be held on 12 September, 2015, in Tokyo.

Sportology shall be a scientific approach to clarify the relationship between sports and health and is a newly defined system of study. While using “sports and health” as keywords to deepen the respective specialized sciences involved, sportology simultaneously integrates each of these specializations, creates and presents opportunities where “deepening and integration” are possible and gives back to society more effective and more efficient academic achievements. Thus, the aim of Sportology is to establish newly academic background for disease prevention and treatment by blending basic and clinical medical sciences, including philosophy and brain science.

The inaugural International Academy of Sportology was held on 5th March, 2011, in Tokyo, and finished with a great success. The proceeding of this meeting was published and sent to 700 members of this association, universities and libraries all over the world. In recent years, several investigations in the field of Sortology, academic back ground to explore what should we do to be healthy, has been published. Thus, we would like to hold the 2nd Congress, International Academy of Sportology on 12 September, 2015, in Tokyo.

We hope you understand our intentions and make a heartfelt request for your assistance with the International Academy of Sportology.

KAWAMORI Ryuzo
Chairman of the 2nd Congress, International Academy of Sportology
Director, Sportology Center, Juntendo University

GENERAL INFORMATION

Period:	Saturday, September 12, 2015
Venue:	ARIYAMA Noboru Memorial Hall Bldg. 7, Juntendo University, Tokyo, Japan http://www.juntendo.ac.jp/english/access/index.html
Main Theme:	Recent Progresses in Sportology
Official Language:	English
Registration:	Onsite registration only, registration fee is free for the participants
Under the Auspice of:	International Academy of Sportology
Supported by:	Mizuno Sports Promotion Foundation

Secretary Office: c/o Department of Metabolism and Endocrinology
Juntendo University Graduate School of Medicine
2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, JAPAN
TEL +81-3-5802-1579
FAX +81-3-3813-5996
E-mail : info@international-academy-of-sportology.jp
URL : http://www.international-academy-of-sportology.jp

ORGANIZATION

Organization of the International Academy of Sportology

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(President, The Japanese Association of Medical Sciences)
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KANEKO Kazuo (Professor, Juntendo University)

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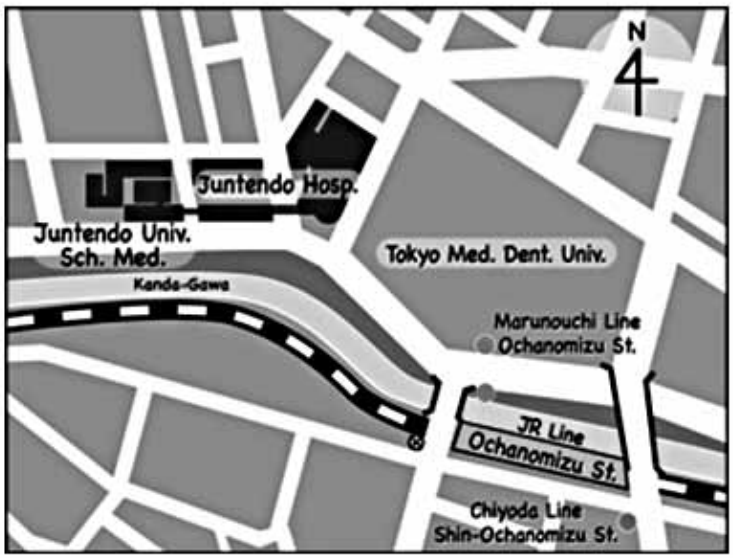
WATADA Hirotaka (Professor, Juntendo University)

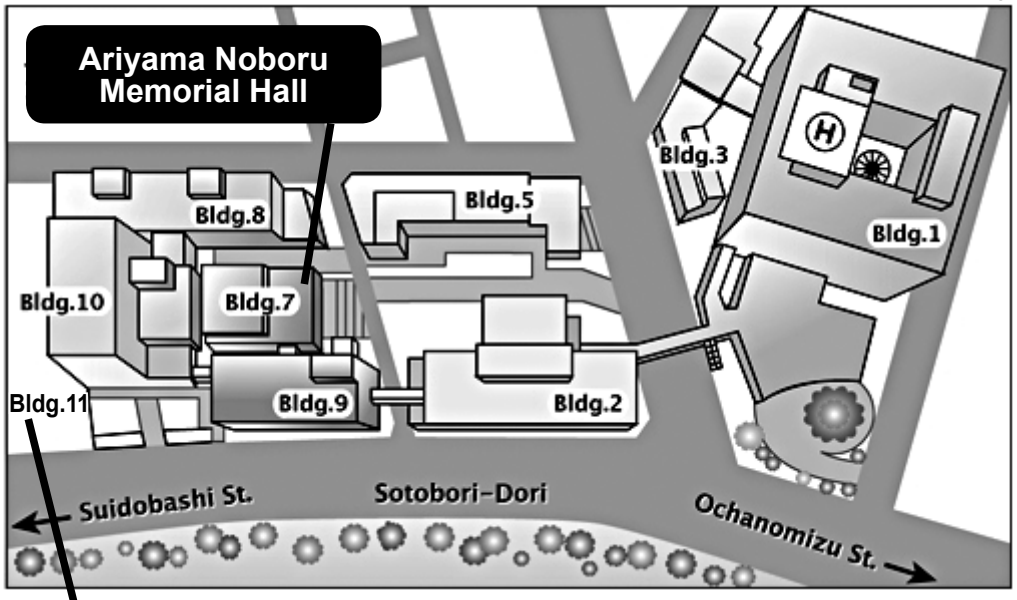
CONGRESS SITE

Access



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

Juntendo University

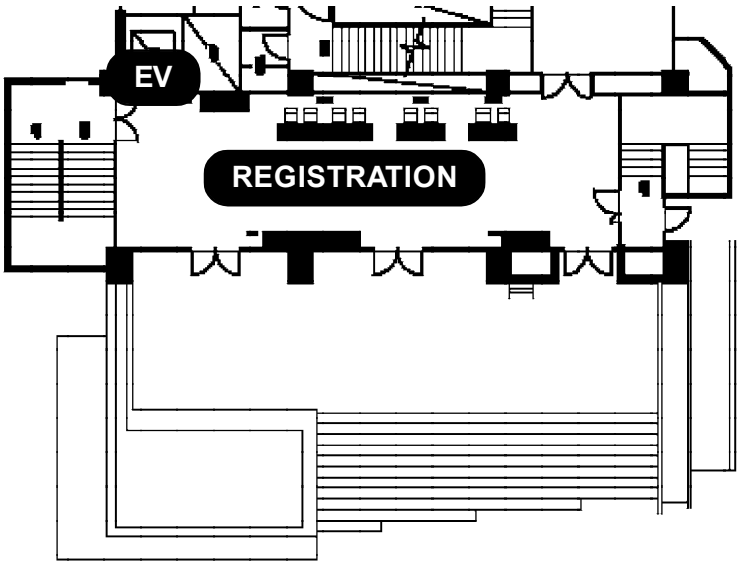


Hongo 2-1-1, Bunkyo-ku, Tokyo 113-8421, Japan
Telephone : 81-3-3813-3111

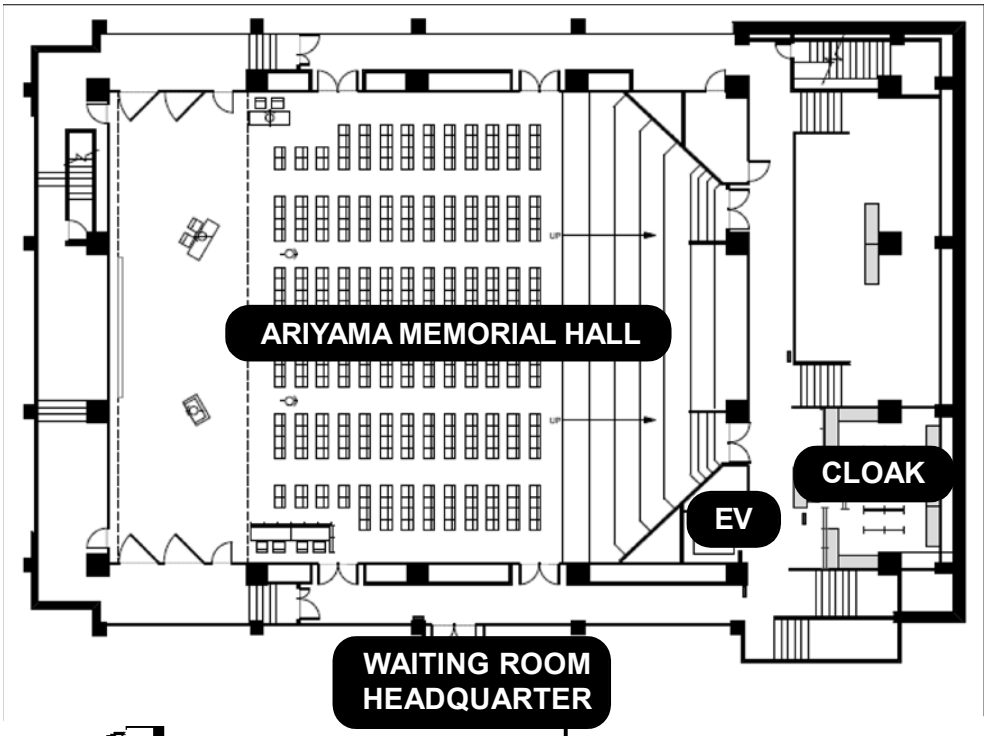
* Get-together Party will be held on the 19th floor
of the Century Tower (Bldg. 11)

Floor Plan

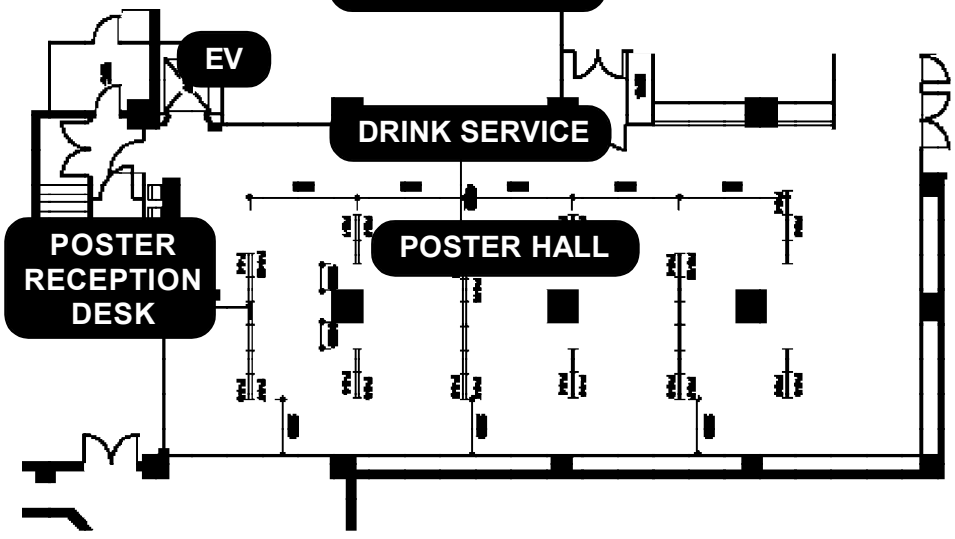
<1F>
Entrance



<3F>
Oral
Session



<B1F>
Poster
Session



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.

VGA Cable(Sample)

- 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.

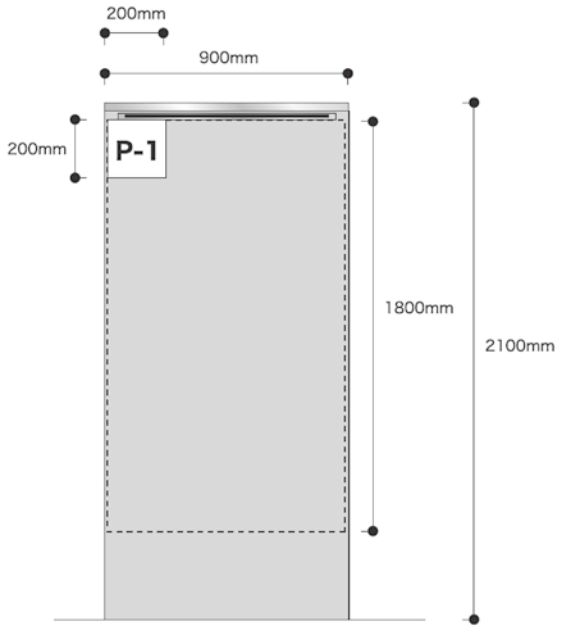
4) At your presentation
Use the mouse and keyboard on the speaker's podium. Your PC will be connected to them.

For Presenters 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 will be provided by the Secretariat. Please visit the Poster Reception Desk located in the Poster Hall (B1F) before poster set-up.



2) Schedule for Poster Sessions

Set-up	9:00- 9:30
Presentation	12:00-13:00
Removal	17:00-17:30

* Note that authors are responsible for setting up and removing their posters.
* All materials which have not removed before 17:30 will be disposed.

3) Instructions for presentation (free discussion)

Presenters are requested to be present in front of their posters during the period of Poster Presentation (12:00-13:00). Please move to your poster after Lecture 5. Poster Presentation will be held as free discussion style during lunch time. Lunch will be prepared by the Organizer, so please feel free to have lunch during this session.

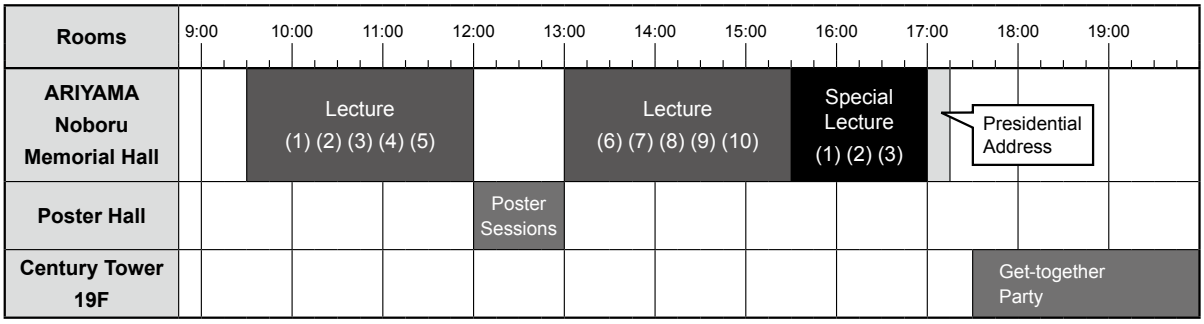
For Chairs in the Oral Sessions

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.

PROGRAM

Program-at-a-Glance



Program

09:30-12:00 Lecture 1 “Does the sports gene affect lifestyle-related diseases?”

Chair: MAEDA Shiro (Prof., Dept. of Advanced Genomic and Laboratory Medicine, Graduate School of Medicine, University of the Ryukyus & Visiting Prof., Sportology Center, Juntendo University Graduate School of Medicine)

Lecturer: FUKU Noriyuki (Assoc. Prof., Juntendo University Graduate School of Health and Sports Science)

Lecture 2 “Current state and future directions of cardiac rehabilitation in Japan”

Chair: MIIDA Takashi (Prof., Dept. of Clinical Laboratory Medicine, Juntendo University Graduate School of Medicine)

Lecturer: DAIDA Hiroyuki (Prof., Dept. of Cardiovascular Medicine, Juntendo University Graduate School of Medicine)

Lecture 3 “Etiology of insulin resistance in non-obese subjects–Juntendo Sportology Center core study–”

Chair: KUBOTA Minoru (Director, Health Care Center & Clinic & Prof., School of Sociology, Kwansei Gakuin University)

Lecturer: WATADA Hirotaka (Prof., Dept. of Metabolism & Endocrinology, Juntendo University Graduate School of Medicine)

Lecture 4 “Sportology to prevent locomotive syndrome”

Chair: NAITO Hisashi (Prof., Dept. of Exercise Physiology, Juntendo University Graduate School of Health and Sports Science)

Lecturer: ISHIJIMA Muneaki (Assoc. Prof., Dept. of Medicine for Orthopaedics and Motor Organ, Juntendo University Graduate School of Medicine)

Lecture 5 “Mechanical regulation and maintenance of homeostasis–Scientific basis for the health promotion by physical motility and exercise”

Chair: KANEKO Kazuo (Prof., Dept. of Medicine for Orthopaedics and Motor Organ, Juntendo University Graduate School of Medicine)

Lecturer: SAWADA Yasuhiro (Director, Dept. of Rehabilitation for the Movement Functions, Research Institute, National Rehabilitation Center for Persons with Disabilities)

12:00-13:00 Poster Sessions

13:00-15:30 Lecture 6 “Development of a small-molecule AdipoR agonist AdipoRon as exercise mimetics”

Chair: WATADA Hirotaka (Prof., Dept. of Metabolism & Endocrinology, Juntendo University Graduate School of Medicine)

Lecturer: YAMAUCHI Toshimasa (Assoc. Prof., Dept. of Diabetes and Metabolic Diseases, Graduate School of Medicine, The University of Tokyo & Visiting Prof., Sportology Center, Juntendo University Graduate School of Medicine)

Lecture 7 “Autophagy in central nervous system neurons–The LC3 conjugation system is involved in lipid droplet formation–”

Chair: UENO Takashi (Affiliate Prof., Research Support Center, Juntendo University Graduate School of Medicine)

Lecturer: UCHIYAMA Yasuo (Prof., Dept. of Cellular and Molecular Neuropathology, Juntendo University Graduate School of Medicine)

Lecture 8 “Human brain mapping of autonomic functions”

Chair: IWATSUBO Takeshi (Dept. of Neuropathology, Graduate School of Medicine, The University of Tokyo)

Lecturer: KONISHI Seiki (Prof., Dept. of Neurophysiology, Juntendo University Graduate School of Medicine)

Lecture 9 “Physical exercise and dementia”

Chair: IWATSUBO Takeshi (Dept. of Neuropathology, Graduate School of Medicine, The University of Tokyo)

Lecturer: MOTOI Yumiko (Assoc. Prof., Dept. of Diagnosis, Prevention & Treatment of Dementia, Juntendo University Graduate School of Medicine)

Lecture 10 “MR imaging for sportology; non-invasive visualization of the brain and muscles”

Chair: IWATSUBO Takeshi (Dept. of Neuropathology, Graduate School of Medicine, The University of Tokyo)

Lecturer: AOKI Shigeki (Prof., Dept. of Radiology, Juntendo University Graduate School of Medicine)

15:30-17:00 Special Lecture 1 “Cutting edge of brain science and sportology”

Chair: KOMINAMI Eiki (President, Juntendo University)

Lecturer: MIYASHITA Yasushi (Prof., Juntendo University & The University of Tokyo)

Special Lecture 2 “Advances in pediatric sports medicine practice in USA.”

Chair: YAMASHIRO Yuichiro (Prof., Probiotics Research Laboratory, Juntendo University Graduate School of Medicine)

Lecturer: Dilip R. PATEL (Western Michigan University, Homer Stryker MD School of Medicine)

Special Lecture 3 “Expectation for sportology to the success of Tokyo Olympic and Paralympics 2020”

Chair: KAWAMORI Ryuzo (Director & Prof., Sportology Center, Juntendo University Graduate School of Medicine)

Lecturer: MIZUNO Masato (Expert Member, IOC Sport and Environment Commission & Honorary Member, Japanese Olympic Committee)

17:00-17:15 Presidential Address : KAWAMORI Ryuzo

17:30- Get-together Party

Poster Sessions 12:00 – 13:00

P-1 “Brain and Circulation”

- 1 Montasir ELAHI (Juntendo University)
  Region-specific vulnerability of neuroinflammation, oxidative stress and Tau hyperphosphorylation in experimental diabetes
- 2 Montasir ELAHI (Juntendo University)
  Short-term treadmill exercise increased oxidative stress and Tau insolubility in tauopathy model mice
- 3 KUDO Daisuke (Juntendo University)
  Quantitative analysis of horizontal eye movements and concentration of serum and plasma BDNF level before and after vision training
- 4 SHIMOJI Keigo (Juntendo University)
  What we learned from brain MR study from the Sportology project
- 5 SUGIHARA Masami (Juntendo University)
  Voluntary exercise preserves cardiac function in DCM model mice
- 6 KAKIGI Ryo (Juntendo University)
  A bout of acute exercise attenuates cardiac dysfunction after ischemia/reperfusion in isolated rat heart
- 7 WAKI Hidefumi (Juntendo University)
  Potential brain mechanisms of cardiovascular regulation during exercise: implications for NTS histaminergic receptors in regulating cardiovascular system
- 8 SHIOZAWA Tomoyuki (Juntendo University)
  Is watching national team matches in World Cup Soccer 2014 on TV associated with increasing ventricular arrhythmia?

P-2 “Health in Children”

- 1 OZAKI Ryosuke (Juntendo University)
  Relationships between club activity stressors, commitment to sports, and resilience in high school athletes belonging to school athletic clubs
- 2 KONNO Ryo (Juntendo University)
  Factors influencing on the parental support of children’s physical activity
- 3 SUZUKI Koya (Juntendo University)
  Japanese adolescents are the most physically fit and active in East and Southeast Asia
- 4 KOSAKA Manabu (Juntendo University)
  A validation study for estimating vertical stiffness and leg stiffness during running in children
- 5 KAMIMURA Akari (Juntendo University)
  The relationship between birth month, physical fitness, motor ability and evaluation from kindergarten teachers for young Japanese children
- 6 PENGYU D (Juntendo University)
  Physical activity of children and adolescents in medium city in China
- 7 KIMURA Yuri (Juntendo University)
  The relationship between toe grip strength and physical fitness in elementary school children
- 8 CHANG Shuo-wen (Juntendo University)
  Changes in the physical fitness of Taiwanese school children in Japan: A cross-sectional study

P-3 “Life Style and Genetic Factor”

- 1 NAITO Hisashi (Juntendo University)
  Polymorphism in the CNTF receptor gene is associated with elite Japanese endurance athlete status: a case-control study
- 2 ZEMPO Hirofumi (Juntendo University)
  The relationship between alpha-actinin-3 gene R577X polymorphism and muscle flexibility
- 3 ITAKA Toshio (Juntendo University)
  Association between the combination of ACTN3, ACE, IGF2 gene polymorphisms and judo status
- 4 SOMEYA Yuki (Juntendo University)
  Long term effect of cardiorespiratory fitness for a prevention against diabetes
- 5 NISHIOKA Emiko (National Defense Medical College, Juntendo University)
  Relationship between physical activity during pregnancy and mood changes after delivery in Japanese women
- 6 IWAASA Takumi (Juntendo University)
  Introduction of diversity fault lines as antecedent to work stress
- 7 TAKAHASHI Hideko (Juntendo University)
  Relationship between assertion types and communication networks of nursing organization at university hospital
- 8 SHOJI Naoto (Juntendo University)
  Developing a guideline for collecting and using feedbacks in Japanese fitness club

P-4 “Muscle Metabolism”

- 1 MANABE Yasuko (Tokyo Metropolitan University)
  An *in vitro* contraction model in mouse primary cultured myotubes using satellite cells originated from EDL and soleus
- 2 KAKEHI Saori (Juntendo University)
  Intramyocellular lipid accumulation after high-fat diet is associated with the gene expression involved in lipid metabolism in skeletal muscle of non-obese men
- 3 FUNAYAMA Takashi (Juntendo University)
  Role of exercise intensity on intramyocelluar lipid level after exercise in subjects with moderate insulin resistance
- 4 IKEDA Shin-ichi (The University of Tokyo)
  Exercise-induced transient increase in IL-6 stimulates GLUT4 expression and enhances insulin sensitivity in mouse skeletal muscle
- 5 FURUKAWA Yasuhiko (Juntendo University)
  Potential usefulness of intrahepatic lipid accumulation and liver function tests to identify insulin resistance phenotype in non-obese type 2 diabetes
- 6 TSUZUKI Takamasa (Juntendo University)
  Effects of exercise before development of type 2 diabetes on glucose and lipid metabolism remain partly following exercise cessation in OLETF rats
- 7 TSUDA Satoshi (Kyoto University)
  Caffeine increases contraction-stimulated 5′-AMP-activated protein kinase activity and insulin-independent glucose transport in rat skeletal muscle

P-5 “Musculoskeletal System”

- 1 SHIMURA Yukio (Juntendo University)
  The exercise therapy decreases the serum interleukin-6 levels in patients with knee osteoarthritis
- 2 ENDO Shinya (Juntendo University)
  The effect of cooling on muscle strength and muscle cross-sectional area during detraining
- 3 EMA Ryoichi (Waseda University)
  Morphological profiles of the quadriceps femoris of varsity athletes
- 4 HADA S (Juntendo University)
  The site-specific associations between the meniscus changes and the osteophyte formations in early-stage knee osteoarthritis

- 5 HIRATA Kosuke (National Institute of Fitness and Sports in Kanoya)
  Influences of hamstring stretching on passive muscle stiffness vary between hip flexion and knee extension maneuver: A pilot study
- 6 SAKAMOTO Akihiro (Juntendo University)
  Hyperventilation-induced respiratory alkalosis increases the number of repetitions able to be performed during resistance training
- 7 Lizu LIU (Juntendo University)
  Biomarkers for cartilage as a predictor of radiographic progression in knee in men in early forties without knee pain
- 8 EGAWA Tatsuro (Toyohashi SOZO University & Kyoto University)
  AMPK-mediated regulation of protein degradation systems in unloaded mouse skeletal muscle
- 9 KAWANISI Noriaki (Juntendo University)
  Role of pathogen sensor on inactivity-induced muscle atrophy
-10 MACHIDA Shuichi (Juntendo University)
  Aging skeletal muscle is associated with increased adipognesis and impaired inflammation
-11 TAKAMINE Yuri (Juntendo University)
  Effects of treadmill running on bone density and strength in young mice
-12 ESHIMA Hiroaki (University of Electro-Communications, Juntendo University)
  In vivo calcium regulation in diabetic skeletal muscle: fiber-type specific effects
-13 KAZUNO Saiko (Juntendo University)
  Metabolome and peptidome analyses of autophagic degradation
-14 MIYAMOTO Aya (Juntendo University)
  Seasonal changes in physical fitness of adolescent track and field athletes
-15 IGUCHI Y(Juntendo University)
  The sprinting ability involved change of direction on the decision making in female soccer players
-16 MAEHANA H(Juntendo University)
  Effects of different visual class on agility in the visually impaired soccer players
-17 ABE Ryo (Juntendo University)
  Impact of muscular evaluation by 3D-CT

P-6 “Locomotive Syndrome”
- 1 NOJIRI Hidetoshi (Juntendo University)
  Contribution of mitochondrial superoxide and SOD2 imbalance to the locomotive syndrome
- 2 OZAKI Hayao (Juntendo University)
  The effect of the combination of increased physical activity with walking with blood flow restriction on leg muscle thickness and walking performance in older adults
- 3 NAKAGATA Takashi (Juntendo University)
  The effects of exercise training combined increase physical activity with walking with blood flow restriction on locomotive syndrome risk test parameters in the elderly adults
- 4 KITADA Tomoharu (Juntendo University)
  Effect of exercise intervention on locomotive syndrome in Japanese elderly
- 5 ISHIHARA Yoshihiko (Juntendo University)
  Relationship between locomotive syndrome risk test parameters and physical activities in elderly people
- 6 YOSHIHARA Toshinori (Juntendo University)
  Assessment of a University-Based Exercise Program for Locomotive and Metabolic Syndrome in the elderly people
- 7 TANABE Yu (Juntendo University)
  An outpatient-based survey about the recognition of locomotive syndrome in Tokyo: A survey for 3 years
- 8 NATSUME Toshiharu (Juntendo University)
  Acute changes in blood lactate concentration, muscle thickness and strength after walking with blood flow restriction in older adults

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(alphabetical order; as of August 7, 2015)

ABSTRACTS

SPECIAL LECTURES

SL-1 Cutting edge of brain science and sportology

MIYASHITA Yasushi
Prof., Juntendo University & The University of Tokyo

SL-2 Advances in pediatric sports medicine practice in USA

Dilip R. PATEL
Western Michigan University, Homer Stryker MD School of Medicine

Participation in sports in the United States over the past 3 decades has seen a move from spontaneous and fun activity by children and adolescents to a more organized and competitive activity largely governed by adults and sports governing organizations. With this shift we have also seen a trend in participation in organized sports at younger age, increase in intensity in activity level, and specialization in a single sport from an early age. These and other factors contribute to an increased incidence of sport related overuse injuries in children and adolescents. Another area of intense debate and scrutiny is the long term neurocognitive impact in adolescents of sport-related concussions. Recognition of adverse long term impact of sport related concussions on developing brain has resulted in increased education efforts, prevention strategies, and legislative activity. Screening of young athletes for cardiovascular disease to prevent sudden cardiac death also continues to be a subject of ongoing intense debate in the United States.

SL-3 Expectation for sportology to the success of Tokyo Olympic and Paralympics 2020

MIZUNO Masato
Expert Member, IOC Sport and Environment Commission & Honorary Member, Japanese Olympic Committee

LECTURES

L-1 Does the sports gene affect lifestyle-related diseases?

FUKU Noriyuki
Assoc. Prof., Juntendo University Graduate School of Health and Sports Science

There are strong genetic components to physical performance-related traits, e.g., muscle mass/strength, cardiorespiratory fitness, and so on. It would be useful to understand the differences in the genomic profile of highly trained athletes of world class calibers and sedentary controls. A number of familial and twin studies have assessed the relative contribution of genetic and environmental factors to physical performance or its-related traits and have estimated that there is a significant genetic component to their phenotypes. Therefore, we have been focused on associations with both nuclear DNA and mtDNA polymorphisms in elite Japanese athlete status from candidate gene-association studies, but there is still not enough evidence to explain the genetic component. Investigators in the field of sports science are now focusing on more detailed analysis of genetic polymorphisms, i.e., genome-wide association studies (GWAS) and/or whole genome/exsome sequencing. This time, I will introduce the evidence of genetic polymorphisms to determine physical performance from both candidate gene-association studies and GWAS. In addition, I also focus on future directions and possibilities to both sports and health sciences.

L-2 Current state and future directions of cardiac rehabilitation in Japan

DAIDA Hiroyuki
Prof., Dept. of Cardiovascular Medicine, Juntendo University Graduate School of Medicine

In Japan, the prevalence of cardiovascular disease has been increasing for the last several decades, especially in urban areas. Previous data strongly support the protective role of lifestyle intervention involving physical activity and dietary modification to improve glucose and insulin homeostasis, lipid profiles, and other risk factors for cardiovascular diseases. Cardiac rehabilitation (CR) is a comprehensive lifestyle intervention including supervised exercise training, risk factor control, patient education, and psychosocial counseling which is effective in reducing the risk of cardiovascular events. However, the implementation of CR in Japan is still low even in the leading cardiovascular institutions. In this Lecture, I will present the recent progress of CR regarding with its safety and efficacy and discuss about the current status and future directions of CR in Japan.

L-3 Etiology of insulin resistance in non-obese subjects -Juntendo Sportology Center core study-

WATADA Hirotaka
Prof., Dept. of Metabolism & Endocrinology, Juntendo University Graduate School of Medicine

It has been well known that Asian people frequently develop type 2 diabetes mellitus and metabolic syndrome without overweight. However, the mechanism underlying this phenomenon has not been clarified yet. To clarify its mechanism will be useful to provide the information about the potential target to prevent these diseases. Thus, as a Sportology Center core study, we tried to elucidate the pathophysiology of metabolic disorders observed in non-obese and non-diabetic subjects. For this purpose, we recruited non-obese and non-diabetic Japanese men. Using a 2-step hyperinsulinemic euglycemic clamp with glucose tracer, we evaluated their insulin sensitivity in muscle and liver. In addition to their custom of diet and exercise, we measured intrahepatic lipid, intramyocellular lipid, visceral fat area and exercise capacity and so on. Then, we searched for the factor that determine the tissue specific insulin resistance and the factors that could be caused by tissue specific insulin resistance. The results suggest the importance of “tissue specific insulin sensitivity” concept for understanding the role and etiology of insulin resistance in non-obese non-diabetic men.

L-4 Sportology to prevent locomotive syndrome

ISHIJIMA Muneaki
Assoc. Prof., Dept. of Medicine for Orthopaedics and Motor Organ, Juntendo University Graduate School of Medicine

Japan faces a future as the most elderly society humankind has ever known, and with that prospect in mind, the Japanese Orthopaedic Association proposed the concept of locomotive syndrome in 2007. It is defined as a condition associated with being restricted in one's ability to walk or lead a normal life owing to a dysfunction in one or more of the parts of the locomotion system, including the muscles, bones, joints, cartilage or the intervertebral discs. This syndrome especially refers to those elderly who have come to need nursing care services because of problems with the locomotive organs, or who have conditions which may require them to have such services in the near future. Steps need to be taken today to prevent locomotive syndrome and to extend the healthy life expectancy of the people living today, so that individuals can continue to be mobile for life.

Osteoarthritis of the knee is an age-related progressive joint disease, which is characterized primarily by cartilage degradation, and is one of the major diseases responsible for locomotive syndrome.

In this presentation, I'd like to focus on the potentiality of the concept "Sportology" to prevent the locomotive syndrome.

L-5 Mechanical regulation and maintenance of homeostasis –Scientific basis for the health promotion by physical motility and exercise

SAWADA Yasuhiro
Director, Dept. of Rehabilitation for the Movement Functions, Research Institute, National Rehabilitation Center for Persons with Disabilities

All the organisms on earth perceive surrounding mechanical environments and adapt to them by converting physical information into biological signals regulating physiological events. Organismal homeostasis therefore relies on mechanical regulation, for which mechano-sensing followed by mechanically induced signal transduction, termed mechanotransduction, is responsible.

To date, mechanical 'stress' has often been referred to excessive physical loading that may induce or deteriorate disorder or inflammation of tissues and organs. For example, hypertension (high blood pressure) causes age-related cardiovascular diseases, including cardiac hypertrophy, atherosclerosis and aneurysm. Extravagant mechanical loading on bone and cartilage arising from obesity, extreme physical exercise or joint instability can give rise to osteoarthritis and imbalanced bone resorption (osteoporosis or fatigue fracture). While contrary to these excessive loadings, loss of mechanical stresses is also detrimental to homeostasis particularly in the case of musculoskeletal organs. For instance, physical inactivity and gravity-free conditions (spaceflight) induce rapid muscle atrophy as well as bone loss. Notably, most of these harmful effects of mechanical stresses involve cell signaling mediated by NF-κB, a transcription factor that plays a key role in regulating inflammatory responses.

Interestingly, physical interventions are typically effective as treatments for the aforementioned mechanical stress-related health problems. Physical therapy, optimal physical exercise and programmed sports activity can redress the mechanically inducible disruption of tissue/organ homeostasis. This clearly indicates the 'beneficial' effects of mechanical stresses on living organisms. However, very little is known concerning the molecular mechanisms behind the positive facets of mechano-sensing and mechanotransduction.

In my talk, I will distinguish between beneficial and detrimental mechanical stresses in view of organismal homeostasis, and discuss why and how loss of mechanical stresses leads to unfavorable consequences in musculoskeletal systems from mechanobiological perspectives.

L-6 Development of a small-molecule AdipoR agonist AdipoRon as exercise mimetics

YAMAUCHI Toshimasa
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In obesity, plasma adiponectin is reduced, which causes insulin resistance and atherosclerosis. We identified its receptors AdipoR1 and R2, and showed that they exert anti-aging effects via activation of AMPK/SIRT1 and PPAR-α pathways, respectively, leading to increased mitochondria as well as decreased ectopic fat accumulation, oxidative stress and inflammation. Recently, we identified orally active small-molecule AdipoR agonist AdipoRon, which bound to AdipoR, showed very similar effects to adiponectin in muscle and liver, such as increased exercise endurance and energy expenditure, and ameliorated insulin resistance via AdipoR in obese mice, leading to healthy longevity. Most recently, we determined and reported the crystal structures of human AdipoR, which will facilitate the understanding of novel structure-function relationships and the optimization of AdipoRon as exercise mimetics.

L-7 Autophagy in central nervous system neurons -The LC3 conjugation system is involved in lipid droplet formation-

UCHIYAMA Yasuo
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Lipid droplets (LDs) are cytoplasmic inclusions that have a neutral lipid core with a single phospholipid layer, while excess free fatty acids and glucose in plasma are converted to triacylglycerol (TAG) and stored as LDs. However, the mechanism for the generation and growth of LDs in cells is largely unknown. LD formation accompanied by accumulation of TAG induced by starvation was largely suppressed in the hepatocytes that cannot execute autophagy. Under starvation conditions, LDs in addition to autophagosomes were abundantly formed in the cytoplasm of these tissue cells. Moreover, LC3 was localized on the surface of LDs and LC3-II (lipidation form) was fractionated to a perilipin-positive lipid fraction from the starved liver. Taken together, these results indicate that the LC3 conjugation system is critically involved in lipid metabolism via LD formation.

L-8 Human brain mapping of autonomic functions

KONISHI Seiki
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The hypothalamus contains several sub-nuclei that regulate autonomic functions such as hunger and thirst. The hypothalamus is a small structure of less than 1 cubic centimeter in each hemisphere of the human brain, and very little is known about precise anatomical organization and functional properties of the hypothalamus in the human brain. The human hypothalamus can be divided into several sub-regions using a boundary mapping method based on the resting-state functional connectivity measured by functional magnetic resonance imaging (fMRI). The defined sub-regions can also be used to track the fMRI signal time-course in each regions when the blood glucose level is manipulated by OGTT. In this talk, we will present some of preliminary results about functional organization of the human hypothalamus that are illuminated in collaboration with departments of endocrinology and radiology.

L-9 Physical exercise and dementia

MOTOI Yumiko
Assoc. Prof., Dept. of Diagnosis, Prevention & Treatment of Dementia, Juntendo University Graduate School of Medicine

With the percentage of the population over 65 yr of age expanding, managing the health and independence of this population is an ongoing concern. Exercise may be one strategy to prevent or delay cognitive decline. In older adults, aerobic exercise training increased size of hippocampus, white matter integrity, and cerebral blood flow. In rodent studies, wheel running and treadmill running remain the best studied modalities. The impact of exercise was found in general, dependent on type, duration, or intensity of physical activity in addition to the time point of intervention. Using Alzheimer's disease model mice, long-term treadmill exercise has been reported to reduce oxidative stress, neuroinflammatory cytokines, aggregated Abeta plaques and tau phosphorylation. To characterize the short-term treadmill exercise on tau modification, we attempted 3 weeks treadmill treatment using old tauopathy model mice (15 months). In contrast to the reports of long-term exercise, our result showed increased oxidative stress, microglial cells and tau phosphorylation. Appropriate physical exercises would be a promising preventive measure to delay the cognitive decline.

L-10 MR imaging for sportology; non-invasive visualization of the brain and muscles

AOKI Shigeki
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Recent advances of MR imaging allows us to visualize the functional and structural changes of the brain not only in the patients with neurological disorders, but also in normal subjects. Sophisticated MR techniques, such as resting-state functional MR and diffusion MR imaging, can depict subtle brain changes in normal subjects in minor abnormalities before metabolic syndrome as well as brain changes after a few weeks muscle training. Minimal structural changes of the brain after repeated minor trauma during sports are now highlighted, because advanced MR techniques show substantial changes of the brain before neurological decline.

By diffusion tensor imaging (DTI), we can explore microstructure of the tissue in vivo through analysis of water diffusion direction and restriction. DTI was developed mainly in the central nervous system to visualize the white matter tracts and their networks. Plasticity of the brain white matter has been reconfirmed with this technique. Skeletal muscles have also direction and restriction of water diffusion and can be analyze by DTI as well.

Recent advances of MR techniques for sportology, especially diffusion MR imaging, will be presented in this lecture.

P-1-1 Region-specific vulnerability of neuroinflammation, oxidative stress and Tau hyperphosphorylation in experimental diabetes

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PURPOSE: Alzheimer disease (AD), involved the abnormal metabolism of β-amyloid and tau, is the major cause of dementia among elderly. Diabetes mellitus (DM) has been identified as a risk factor of AD. Two pathological lesions of AD, Aβ plaques and neurofibrillary tangles, are linked to neuroinflammation and lipid peroxidation, are also induced by abnormal glucose metabolism. Here, we examined the effects of experimental DM in tau transgenic mice Tg 601 (overexpressing wild-type human tau) and analyzed the brain regional difference occurred due to DM in AD.

METHODS: Hippocampus, midbrain and cerebellum were analyzed from streptozotocin (STZ) injected of Tg601 and non-transgenic (NTg) mice. Immunoblotting and immunohistochemistry (IHC) were performed to assess tau hyperphosphorylation, and IHC to evaluate Ionized calcium binding adaptor molecule-1 (Iba-1) and CD68 positive microglia. Inflammatory cytokines including IL-1β, IL-6, and IL-10 were assayed using multiplexed bead based immunoassay. IL-18 was measured by enzyme linked immunosorbent assay (ELISA) and lipid peroxidation products 4-hydroxy-trans-2-noneal (HNE) and malondialdehyde (MDA) by ELISA and thiobarbituric acid reactive substances assay, respectively.

RESULTS: STZ injection induced tau hyperphosphorylation, as detected by AT8 and AT 180 antibodies, in the hippocampus, but not in the cerebellum or midbrain of Tg601 and NTg mice. STZ treatment also elevated the number of Iba1-positive microglial cells, levels of IL-1β, IL-6, IL-10 and IL-18, and lipid peroxidation markers MDA or HNE in the hippocampus of the brain.

CONCLUSIONS: These results indicated that hyperglycemia-induced tau hyperphosphorylation, neuroinflammation and oxidative stress occurred more severely in the hippocampus than other parts of the brain and could contribute to selective neurodegeneration in human AD.

P-1-2 Short-term treadmill exercise increased oxidative stress and Tau insolubility in tauopathy model mice

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BACKGROUND: Physical exercise has been reported as a preventive measure of Alzheimer's disease, one of the neuropathological hallmarks of which, neurofibrillary tangles, consist of hyperphosphorylated insoluble tau. Long-term treadmill exercise reduced tau hyperphosphorylation; however, it remains unknown whether short-term treadmill exercise alters tau modifications.

AIM: Here we attempted to characterize the effects of short-term treadmill exercise on tau solubility and determine its relationship with neuroinflammation using tauopathy model mice (Tg601).

RESULTS: 3 weeks of non-shock treadmill exercise in Tg601 and non-transgenic mice markedly increased insoluble tau by increasing the phosphorylation at the tau C-terminal end, particularly at Ser396. The results of immunohistochemical analyses revealed that short-term treadmill exercise increased the number of Ionized calcium binding adaptor molecule-1 (Iba-1) positive microglia in the hippocampus. Elevations in the levels of the lipid peroxidation markers 4-hydroxy-trans-2-noneal and malondialdehyde indicated the presence of oxidative stress.

CONCLUSION: Our results suggested that short-term forced exercise was harmful rather than beneficial to Alzheimer's pathology.

P-1-3 Quantitative analysis of horizontal eye movements and concentration of serum and plasma BDNF level before and after vision training

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PURPOSE: Eye movements are important factors for dynamic visual acuity (DVA) that refers to the ability to perceive fine details of a moving object. When tracking a moving visual stimulus, we often combine smooth eye movements with catch-up saccades. The velocity of saccade eye movements (up to 500-600 deg/s) is much faster than smooth pursuit (usually less than 50 deg/s). Even though a tracking ability using these two kinds of eye movements is thought to play a critical role in DVA, it is still uncertain whether better DVA is associated with an ability of catch-up saccades. The first purpose of this study was to quantitatively clarify the effects of vision training on DVA and eye movements. Therefore, we repetitively measured the eye movements during DVA training and attempted to determine the effects of visual training on saccade eye movements. The second purpose was to assess the concentration of serum and plasma Brain-derived neurotrophic factor (BDNF) level before and after vision training. BDNF is a member of the neurotrophin family of growth factors, which are related to the canonical Nerve Growth Factor. Previous studies have reported that moderate intensity exercise leads to increase in BDNF. However it is unknown whether BDNF level is correlated with eye movements. Therefore, we examined the correlation between BDNF level and eye movement parameters.

METHODS: DVA was evaluated by a moving visual target (Landolt ring) that was projected on the front screen (HI-10; Kowa, Japan). Eye movements were detected using a video based eye tracking system (Eye Link1000; SR research, Canada). We have performed measuring DVA in five subjects (mean age; 19.0±2.6, age range; 19 to 21 years old) and analyzed saccades eye movements quantitatively using custom analytical software (Matlab; Mathworks Inc., USA). Subjects were seated in front of a screen and put their jaw on a chin supporter of our device to stabilize the head. The subjects were asked to follow the Landolt ring moving across in front of their visual field and judge the direction of the slit. We analyzed saccade latency (msec), peak velocity (deg/sec), error (deg) and a correct response rate (%). The Landolt ring moved either from right to left or left to right with constant speed of 300deg/s. A total of eight measurements were performed for each subject. We took blood samples from each subject before and after vision training and checked serum and plasma level of BDNF.

RESULTS: Our results demonstrated that saccade latency and error showed significant decreases and the correct response rate increased after training for five subjects. Especially for the result of correlation analysis, the correct response rate showed a correlation coefficient of 0.63 ($p = 0.021$), indicating a stronger correlation than the other three parameters. In contrast, saccade peak velocity showed different results among subjects. For three subjects, the velocity increased while two subjects showed a decrease in velocity after training. The results of the analysis showed a significant positive correlation of the concentration of plasma BDNF level with velocity and the correct response rate. However, the results showed a significant negative correlation of the concentration of plasma BDNF level with latency and error. It was also revealed that the results of plasma and serum BDNF level were contrary to each other.

CONCLUSION: Our study provided several lines of evidence showing that saccade eye movements, such as latency, error and peak velocity changed after vision training. Since our results showed that visual training improved DVA, better DVA could be associated with the tracking ability using catch-up saccades. We were also able to clarify that the plasma and serum BDNF possibly affected actual eye movements.

P-1-4 What we learned from brain MR study from the Sportology project

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Although it is widely accepted that cerebrovascular events associated with diabetes mellitus adversely affect the brain, it is less well known that diabetes mellitus itself or even prediabetes can also do so. In this presentation, we focus on this issue by using evidence from recent diffusion tensor neuroimaging studies of patients with diabetes mellitus or metabolic syndrome.

First, through the Sportology project, we explored the regional patterns of white matter alteration in subjects with metabolic syndrome. We also investigated whether the degree of white matter alteration was correlated with BMI. Seven middle-aged men with metabolic syndrome and seven without metabolic syndrome underwent diffusion tensor imaging. MRI scans were performed with a 3.0-T unit (Achieva; Philips Medical Systems, Best, the Netherlands). We analyzed the resultant fractional anisotropy (FA) values by using a tract-based spatial statistics technique. We subsequently measured the mean FA values of the right inferior fronto-occipital fasciculus (IFOF) in all subjects by using a tract-specific analysis. We used Pearson's correlation coefficient to evaluate the relationship between BMI and the mean FA value in the right IFOF. In the whole-brain analysis, subjects with metabolic syndrome had significantly lower FA values than control subjects in part of the right external capsule (which is part of the right IFOF), the entire corpus callosum, and part of the deep white matter of the right frontal lobe. In the regional brain analysis, the mean FA value of the right IFOF was 0.41 ± 0.03 in subjects with metabolic syndrome and 0.44 ± 0.05 in control subjects. A significant negative correlation was observed between BMI and FA values in the right IFOF ($r = –0.56$, $P < 0.04$). These results suggest that there are microstructural changes in the white matter of middle-aged individuals with metabolic syndrome. Our findings add to the increasing body of neuroimaging evidence on white matter alteration in patients with hypertension, diabetes, or metabolic syndrome. Microstructural alterations in the white matter of younger obese individuals may precede brain atrophy or cognitive impairment, or both, in advanced metabolic syndrome.

Second, again through the Sportology project, we explored the regional patterns of white matter alteration in 15 hypertensive middle-aged male participants and 11 normotensive controls by using diffusion kurtosis imaging (DKI)-based whole-brain analysis. DKI data were acquired by use of a single-shot, spin-echo planar imaging sequence. Mean diffusional kurtosis (MDK) values in many brain regions were higher in subjects with hypertension than in control subjects, indicating that there were widespread microstructural changes in the white matter, whereas the conventional diffusion metrics of FA did not differ significantly between subjects with hypertension and normal controls. Moreover, MDK values over the whole brain were significantly and positively correlated with systolic and diastolic blood pressure. This finding suggests that microstructural white matter changes occur in middle-aged men with hypertension, even before the onset of cerebrovascular disease. DKI might therefore be useful as a screening tool for risk of cerebrovascular disease.

DTI is completely noninvasive and is sensitive to white matter pathology in a number of disorders, including metabolic syndrome, in the human brain in vivo. Accumulated evidence highlights the need to further elucidate the relationship between metabolic syndrome and other neuronal mechanisms. A clear understanding of these relationships is crucial for managing patients with metabolic syndrome.

P-1-5 Voluntary exercise preserves cardiac function in DCM model mice

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BACKGROUND: Dilated cardiomyopathy (DCM) is one of major causes of heart failure (HF), characterized by ventricular dilatation and contractile dysfunction. In addition to HF, about 30-40% of patients with DCM die from premature death with lethal arrhythmia. To date, the exercise is considered to be one of therapy for HF as shown in the guideline for chronic HF (Japanese Society of Cardiology in 2010). However, the effects of exercise on DCM patients are still unclear, because evaluation of exercise therapy in DCM patients is associated with risks of worsening of HF or sudden cardiac death. Investigations with animal models of inherited DCM are necessary. Previously, we have established the method to evaluate the severity of HF using a mouse model of DCM (Sugihara et al. PLoS One, 2013). In the course of these studies, we found that voluntary exercise started at young age significantly prolongs survival rate of DCM mice. In this study, we investigated the effects of voluntary exercise on the cardiac function and arrhythmogenesity in DCM model mice.

METHODS: We used a knock-in mouse model having one of human inherited DCM mutation, TNNT2 ΔK210, which decreases Ca^{2+} sensitivity of myofilaments (Du et al. Circ Res 2007). Homozygous ΔK210 (below are called DCM mice) and wild type (WT) mice at 1 month-old were housed with a running wheel (diameter = 12 cm) every 48 hours or all day long, and daily voluntary running activity was recorded. At 2 month-old, end-diastolic dimension and ejection fraction (EF) were measured by echocardiography. Heart, lung and lower extremity muscle (soleus, plantaris and gastrocnemius muscles) were excised and their weights were measured together with body weight. Gene expressions of major ion channels (Kv1.5, Kv4.2, KChiP2, Nav1.5, Cav1.2, etc.,) were quantified by real time PCR analysis.

RESULTS AND DISCUSSION: DCM mice died with t1/2 of approximately 70 days as reported previously (Du et al. 2007). The average lifespan of the DCM mice who continued running exercise every 48 hours was about 20 days longer than that without exercise. Moreover, systolic cardiac function defined by the average EF was higher in DCM mice with exercise than in those without exercise [0.47 ± 0.10 ($n = 7$) vs. 0.31 ± 0.10 ($n = 4$), $P < 0.05$]. On the other hand, electrical remodeling such as down-regulation of multiple types of K^+ channels and accessory subunits has been reported in the DCM mice and closely related to the arrhythmogenesity in them (Suzuki et al. PLoS One 2012). Some of these expression in DCM mice starting exercise at young age were relatively preserved ($n = 6$). We further discuss the relationship between cardiac function, electrical remodeling and leg muscle weights as a measure of exercise intensity.

P-1-6 A bout of acute exercise attenuates cardiac dysfunction after ischemia/ reperfusion in isolated rat heart

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BACKGROUND: Cardiovascular disease, including ischemia/reperfusion (I/R) injury, remains a major cause of morbidity and mortality in industrialized nations. Regular bouts of endurance exercise protect the heart against I/R-induced injury. However, effects of acute exercise immediately before ischemic events on myocardial dysfunction after reperfusion remain unclear. In the current study, we examined (1) whether a single bout of acute exercise reduces cardiac dysfunction after I/R in a rat Langendorff-perfused heart model, and (2) whether a single session of exercise up-regulates intracellular signaling pathway involved in cardioprotection in rat heart.

METHODS: Male Sprague-Dawley rats were divided into two groups; sedentary control (CON) and exercise (EX) group. In EX group, rats received one session of exercise, which consisted of running on a treadmill (1% grade) at 20-25 m/min for 30 min. At ten minutes after the completion of exercise session, the hearts were excised from the rats for Langendorff perfusion experiment and Western Blotting analysis. In Langendorff perfusion experiment, the hearts were exposed to global ischemia (20 min) followed by reperfusion (45 min), and left ventricular developed pressure (LVDP) and heart rate (HR) during I/R were measured. Using western blotting analysis, the phosphorylation of Akt, mammalian target of rapamycine (mTOR), protein kinase C epsilon (PKCε), glycogen synthase kinase 3 beta (GSK-3β) in left ventricular were analyzed.

RESULTS: Acute exercise significantly elevated blood lactate concentration (2.45 ± 0.66 vs. 3.12 ± 0.66 mmol/L [mean ± SD], $p < 0.05$). In Langendorff perfusion experiment, there was no difference in LVDP and HR before I/R between CON (n=13) and EX (n=12) groups. Cardiac contractile activity expressed as pressure rate product (PRP = LVDP × HR), was significantly higher in EX group than in CON group during 5-20 min after reperfusion. In Western blotting analysis, the phosphorylation of mTOR, PKCε and GSK-3β in left ventricular of EX rats (n=8) significantly increased compared with those of CON rats (n=8) (1.61, 1.15 and 1.48 fold, respectively, $p < 0.05$). Akt phosphorylation, which is upstream of mTOR, PKCε and GSK-3β, tended to increase after exercise (1.42 fold, $p = 0.082$).

CONCLUSIONS: A single bout of acute exercise attenuates cardiac dysfunction after I/R in isolated rat heart. In addition, acute exercise increases cardiac Akt, PKCε and GSK-3β phosphorylation, which is associated with the inhibition of mitochondrial permeability transition pore and apoptosis. Therefore, our data suggests the possibility that the activation of intracellular signal transduction induced by acute exercise has resulted in the reduction of cardiac dysfunction after I/R.

P-1-7 Potential brain mechanisms of cardiovascular regulation during exercise: implications for NTS histaminergic receptors in regulating cardiovascular system

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Generally, a single bout of exercise induces a moderate increase in arterial pressure (AP) with marked tachycardia as a result of sympathoexcitation. However, the brain mechanisms underlying cardiovascular regulation during exercise still remain unknown. The nucleus of the solitary tract (NTS) is known as a pivotal region which integrates the baroreceptor sensory information with other inputs such as muscle afferents and descending signals from the hypothalamic area, making it an ideal site for generating cardiovascular controls during exercise. In the present study, we have investigated whether the NTS play an important role in regulating cardiovascular system during exercise with a focus on the central monoaminergic system. We microinjected biological monoamines or their receptors agonists including catecholamine-, histamine-, and serotonin-receptors specific agonists into the NTS of urethane-anaesthetized rats and their effects on cardiovascular parameters were assessed. We found that activation of histamine receptor H1 expressed in the NTS induced pressor and tachycardiac responses, demonstrating similar cardiovascular responses to a single bout of exercise. The maximal responses of AP and heart rate (HR) changes induced by H_1 receptor specific agonist were dose dependent. We confirmed gene expression of histamine receptors in the NTS and that the expression level of H_1 mRNA was higher than that of the other subtypes. We also found that H_1 receptors are mainly expressed in neurons of the NTS. Finally, we confirmed that H_1 receptors-induced cardiovascular responses exhibit functional plasticity after long-term daily exercise. These findings suggest that H_1 receptors in the NTS are involved in cardiovascular regulation during exercise. Since the NTS is one of the nuclei which receive axons of histaminergic neurons located in the tuberomammillary nucleus (TMN) in the posterior hypothalamus, we postulate that the TMN-NTS pathway have an important role in a central feed forward mechanism (central command) underlying pressor and tachycardiac responses to a single bout of exercise. This study was supported by the JSPS (21300253, 24500793).

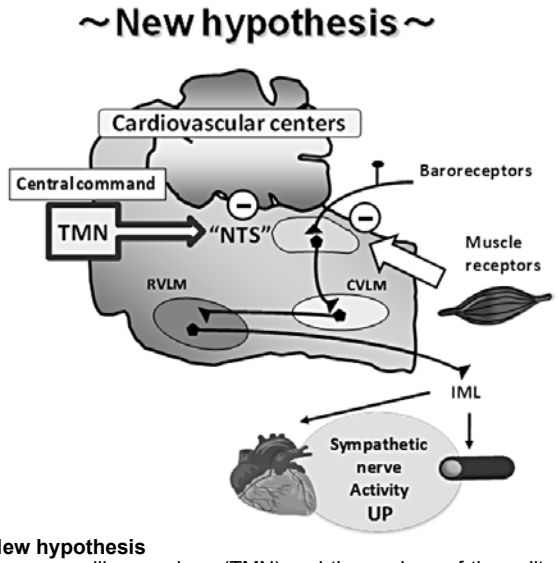

Fig 1. New hypothesis
The tuberomammillary nucleus (TMN) and the nucleus of the solitary tract (NTS) pathway may have an important role in regulating cardiovascular responses during exercise.

P-1-8 Is watching national team matches in World Cup Soccer 2014 on TV associated with increasing ventricular arrhythmia?

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BACKGROUND: Psychological triggers such as emotional stress increase the incidence of acute cardiovascular events. The association between soccer championships and the risk of cardiovascular events are controversial. World Cup Soccer (WCS) involving the national team might be a strong enough trigger to induce cardiac arrhythmia. However, there are no reports which investigated the relationship between WCS and cardiac arrhythmia in the Japanese population.

METHODS: We assessed 25 patients who were evaluated ischemic changes and/or arrhythmia by 24-hour Holter ECG during WCS 2014 in 4 Cardiology Divisions. The patients were divided into two groups [Watching group (n=7) patients who watched WCS on live-TV on June 20 (Japan vs. Greece) or July 25, 2014 (Japan vs. Colombia), and No-watching group (18 patients)]. The heart rates, arrhythmia, and ischemic changes were evaluated.

RESULTS: There were no significant differences of clinical characteristics, heart rates, frequency of premature atrial contractions, and ischemic changes between the two groups. The frequency of premature ventricular contractions (PVCs) of the Watching group and the No-watching group did not differ (672±845 vs. 237±472, P=0.11), but the frequency of PVCs during live-TV in the Watching group was significantly higher than in the No-watching group (61±101 vs. 7±8, P=0.03). No sustained ventricular tachycardia or fibrillation was recorded.

CONCLUSIONS: A significant association between watching WCS and the frequency of PVCs was observed. These data suggest that emotional stress while watching national team soccer matches may induce stress-related cardiovascular events.

P-2-1 Relationships between club activity stressors, commitment to sports, and resilience in high school athletes belonging to school athletic clubs

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INTRODUCTION: School athletic clubs serve as central sites of sports activities for many junior and senior high school students in Japan. School athletic clubs preserve the traditions of pre-war junior and senior high schools, and constitute a sports-education system unique to Japan. Although other countries maintain athletic clubs, only in Japan is there a system, an environment, and leaders (schoolteachers) under which school athletic clubs seek to win national championships. This system is characterized by the incorporation of sport within school-based education; this arrangement allows students to regularly perform athletic activities. Three million junior and senior high school students spend 700 hours each on athletic club activities annually. These facts indicate a large number of school athletic clubs performing extremely intensive physical training activities. The question thus arises: do school athletic clubs' activities truly cultivate the minds and spirits of young athletes, given the current environment has these problems? In our study, we surveyed athletes belonging to school athletic clubs to examine relationships between concepts related to mental strength and ideas about sports. The authors specifically addressed sport commitment and resilience. Scanlan et al. proposed a theory of sport commitment, which describes athletes' persistence in, connection with, and devotion to sports. Research has examined resilience since the 1990s; in Japan, resilience has been discussed in terms of 'ability to recover' and 'restoration of strength'. Resilience has also been considered 'mental strength', which enables one to recover from stress or negative life events, and to recuperate after harm. Additionally, as students may experience a variety of stressors unique to school athletic clubs, stress measures specific to these clubs were used. This study aimed to investigate relationships among these factors.

METHOD: Anonymous questionnaire surveys were administered. Participants were students (n = 203) attending private high schools in the Tokyo metropolitan district. Questionnaires were (1) Hagiwara et al.'s Commitment to Sports Scale, (2) the Resilience Scale developed by Yamagishi and revised by Oshio and Ishige et al., (3) Shibukura et al.'s Stressor Scale for High School Athletic Club Members, and (4) a face sheet inquiring whether the participant is a member of a school athletic club. For follow-up investigation, each participant was issued a password. Data were collected from the 11th to the 15th of May 2015.

Results: Factor analysis of Resilience Scale scores extracted five factors that differed slightly from factors reported in previous research: 'positive future orientation and optimism', 'pursuit of novelty', 'emotional adjustment and optimism', 'relationship orientation', and 'metacognition orientation and emotional adjustment'. Factor analysis of scores on the Stressor Scale for High School Athletic Club Members extracted the same five factors as in previous research: 'competitiveness', 'coaches', 'practice time', 'comrades', and 'injury or illness'.

We subsequently internally analysed the athletic club member group. Using the mean score on the Commitment to Sports Scale (M = 23.95, SD = 5.14), we divided participants into an 'above-mean group' (n = 94) and a 'below-mean group' (n = 58), and then investigated relationships between the two groups' scores on the Resilience Scale and the Stressor Scale for High School Athletic Club Members. Scores were compared using analysis of variance. Scores on each factor of the Resilience Scale were compared between the above- and below-mean groups. Scores were significantly higher for all factors in the above-mean group ($p < .01$) (Figure). Similarly, regarding the Stressor Scale for High School Athletic Club Members, analysis of variance was used to compare the above- and the below-mean group. Results showed that the below-mean group's scores on four factors—'competitiveness', 'coaches', 'practice time', and 'comrades'—were significantly higher ($p < .01$ or $.05$) (Figure).

DISCUSSIONS: Regarding the Commitment to Sports Scale's above- and below-mean groups, significant differences were observed between these two groups in scores on the Resilience Scale and on the Stressor Scale for High School Athletic Club Members; the above-mean group had significantly higher Resilience Scale scores. This suggests that a persistence in and devotion to sports may strengthen resilience.

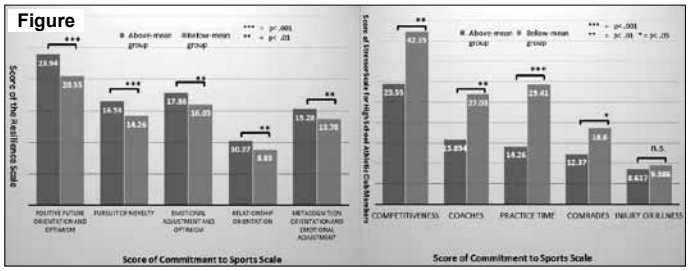
Further, regarding the Commitment to Sports Scale, stressor scores for 'competitiveness', 'coaches', 'practice time', and 'comrades' were significantly higher in the below-mean group. We consider this indicates a tendency to find these factors more stressful when commitment to sports is low.

It is of critical interest that opposing tendencies were observed in scores on the Resilience Scale and on the Stressor Scale for High School Athletic Club Members when comparing the above- and below-mean groups. We plan to complete follow-up surveys examining these effects, to further investigate relationships between these scales.

CONCLUSIONS: The results of our survey of High School athletes who are members of school athletic clubs suggests the following:

- Greater commitment to sports is significantly related to greater resilience.
- Less commitment to sports is significantly related to increased feelings of stress regarding school athletic club activities.

Figure



Relationship between Score of the Resilience Scale and Score of Commitment to Sports Scale (Left)
Relationship between Score of Stressor Scale for High School Athletic Club MembersScore of Commitment to Sports Scale (Right)

P-2-2 Factors influencing on the parental support of children's physical activity

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INTRODUCTION: Nowadays, children's amount of physical activity is decreasing, and mental and physical health becomes our society's concern. However, because many factors are related to children's opportunity to start exercising and their regular exercising, it is possible to learn a desired lifestyle and practice healthy behaviors. Furthermore, the regular exercise starting in childhood predicts one's later exercise habit more than the exercise started in adulthood. The reasons that children start exercising are related to their own will in addition to the influence from their surroundings, such as school, community, friends, and family. Family influence is considered to be a strong factor affecting on children. Trost and his colleagues (2003) found that parental support was important to facilitate children's healthy behaviors, to increase children's self-efficacy, and to directly influence children's levels of physical activity. Parental exercise habit and support to children's physical exercise influenced on the development of children's exercise habit (Konno et al., 2014a; Konno et al., 2014b). What kind of factors are influencing on supporting physical activity? Considering parents' current and past thoughts and behaviors and how they relate to their children, the current study focused on parents' past level of competitiveness in sports and parenting attitude toward raising children. Revealing these relationships and educating parents to provide appropriate support to their children would lead to increasing children's starting exercise and their continuation, which in turn might prevent various illness and promote mental and physical health.

PURPOSE: The purpose of the current study was to assess the influence of parents' past level of competitiveness in sports and parenting attitude on parental support to children's physical activity.

METHOD: Participants were 256 parents of college freshmen (fathers = 119, mothers = 137; mean age = 50.5, SD = 3.87, range = 41-61). Questionnaires included the Parental Support Scale (PSS), the past levels of competitiveness in sports, and the Parenting Attitude Scale (PAS).

RESULTS AND DISCUSSION: The exploratory actor analyses (principal factor method with promax rotation) were conducted on the PSS and the PAS, separately. The results revealed that the PSS consisted of 3 factors with 4 items each (total of 12 items) and the PAS consisted of 2 factors with 4 items each (total of 12 items). The reliabilities and validities of these two scales were also assessed. In the multiple regression analyses, the PSS was set as a dependent variable, and the PAS and the level of competitiveness in sports were set as independent variables. The analyses were conducted separately on fathers and mothers and separately on male and female children. The path models showed the gender difference between fathers and mothers and difference between male and female children, and both the parenting attitude and the level of competitiveness in sports distinctively influenced on the parental support of children's physical activity.

P-2-3 Japanese adolescents are the most physically fit and active in East and Southeast Asia

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Graduate school of Health and Sports Science, Juntendo University[1)]; Nanyang Technological University[2)]; Kyung Hee University[3)]; National Yang-Ming University[4)]; Shanghai University of Sport[5)]; The National University of Malaysia[6)]; Mahidol University[7)]; The Chinese University of Hong Kong[8)]

INTRODUCTION: There are strong evidences showed that lack of physical activity and low levels of physical fitness were important predictors for some chronic diseases including obesity and cardiovascular disease. Some longitudinal studies also indicated that the physical fitness and physical activity levels during adolescence were associated with their disease risk in adulthood. Some studies suggested that culture, education system, economic and social context may influence children's physical activity, physical fitness, and weight status. Comparing the physical activity, physical fitness, and weight status is very important in physical activity promotion and obesity prevention in the future. In 2012, The Asia-Fit Study was lunched in order to compare levels of physical fitness, physical activity and obesity of adolescents among major metropolitan cities in East and Southeast Asia. The study report was summarized in a final report submitted to NUS-Global Asia Institute by Prof. Stanley Sai-Chuen Hui of The Chinese University of Hong Kong.

PURPOSE: Focusing on Japanese data in the final report, we compared the level of physical activity, physical fitness, and obesity of adolescents among major metropolitan cities in East and Southeast Asia.

METHODS: A total of 12590 valid adolescents' data (age 12-15 years) were collected from eight major metropolitan cities in East and Southeast Asia, including Hong Kong, Shanghai, Tokyo, Seoul, Kuala Lumpur, Taipei, Singapore and Bangkok. Analytic items included body mass index (BMI), self-reported MVPA (IPAQ), and whether or not students engaged in sports club activity at school. Physical fitness tests included Sit-and-reach Test (flexibility), Hand Grip test (strength), 1 Minute Sit-up Test (muscle endurance) and 15 meters Progressive Aerobic Capacity Endurance Run (PACER) Test (cardiovascular endurance).

RESULTS: Prevalence of sports club participants with 2 hours or more of physical activity each week in Tokyo (Male: 49.7%, female: 36.7%) was considerably higher than the other cities (Male: 15.7%, female: 10.5%). MVPA, Cardiovascular endurance, and muscle endurance in Tokyo were higher than the other cities (Table 1). Japanese adolescents also indicated larger standard deviations than the other cities in cardiovascular endurance and MVPA. There were no significant differences in strength and flexibility.

CONCLUSIONS: These findings suggested that Japanese adolescents were the most physically fit and active, whereas individual variability in the level of physical fitness and activity were much bigger than the other countries' adolescents.

This work was carried out with the aid of a research grant from the NUS Initiative to Improve Health in Asia (NIHA).

Table 1. Comparisons of Japanese adolescents and the other countries' adolescents

Gender	Country	BMI (kg/m^2)	Hand Grip (kg)	Sit and reach (cm)	Sit up (reps)	PACER (reps)	MVPA (min/wk)
Male	Japanese	19.5±3.3	55.9±14.9	50.7±9.6	45.5±12.3	72.7±24.5	649.8±591.6
	The others	20.9±4.3	58.2±14.8	51.7±10.5	37.4±10.8	45.8±20.8	370.7±425.0
Female	Japanese	19.5±2.9	44.9±8.4	57.2±10.4	36.5±10.7	45.2±16.5	373.1±424.9
	The others	20.6±3.9	43.6±8.9	56.2±10.8	28.1±9.8	27.6±11.0	243.6±299.4

Note. Average±Standard deviation

P-2-4 A validation study for estimating vertical stiffness and leg stiffness during running in children

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INTRODUCTION: During running, the spring-mass model consisting of a particle of the body mass and a leg supporting the particle as a linear spring, so called “leg spring”, has been widely used to describe storage and return of elastic energy in lower limbs (McMahon & Cheng, 1990; Farley & Gonalez, 1991, 1996). A main parameter to describe lower limbs as the leg spring is leg stiffness which is defined as a ratio of peak ground reaction force to the maximal variation of leg length during stance phase. Additionally, vertical stiffness justified by McMahon & Cheng (1990) is used to describe the vertical motion of the center of mass during the foot is in contact with the ground. Morin et al (2005) developed a simple method for estimating vertical stiffness and leg stiffness. In our knowledge, it is not validated that vertical stiffness and leg stiffness in children estimated by using Morin’s method.

PURPOSE: The purposes of this study were 1) to identify vertical stiffness and leg stiffness during running in children, and 2) to validate the two variables estimated by using Morin’s method.

METHOD: A hundred twenty seven children (age 6-12 yrs, height 1.122-1.756 m, body mass 17.1-70.8 kg) participated in this study. The protocol of this study was approved by the Ethics Committee of Department of Sports Science at Juntendo University. Each subjects performed to sprint in 50 m and the whole body during the subject run through an interval from 30 m to 40 m was recorded with high-speed camera at 300 Hz from the sagittal plane. The running speed, contact time in stance phase and flight time was measured to estimate maximal force exerted on the foot (F_{max}), vertical stiffness (k'_{vert}) and leg stiffness (k'_{leg}) by Morin’s method (2005). In gold standard method (MacMahon and Cheng, 1990), ratio of F_{max} to vertical excursion of center of mass and to leg length variation was calculated as the vertical stiffness (k_{vert}) and leg stiffness (k_{leg}). Intra-class correlation coefficients (ICCs) of vertical stiffness and leg stiffness were calculated to assess a validity of the variables estimated by Morin’s method relative to gold standard method. The statically significant level was set in 0.05.

RESULT AND DISCUSSION: All values are represented in mean value ± standard deviation (SD). k'_{vert} was 15.51 ± 5.97 kN/m, whereas k_{vert} was 17.92 ± 6.59 kN/m. The mean difference of the k'_{vert} between k_{vert} was -2.41 ± 2.62 kN/m. ICC between k'_{vert} and k_{vert} was 0.851 ($p < 0.001$). Where mean k'_{vert} demonstrated slightly lower value (-13.4%) relative to mean k_{vert}, ICC of k'_{vert} with k_{vert} was found high. Mean k'_{leg} and k_{leg} was 5.21 ± 1.91 kN/m and 6.81 ± 2.57 kN/m. ICC between k'_{leg} and k_{leg} was 0.642 ($p < 0.001$), while k'_{leg} was highly correlated with kleg ($r=0.839$). Additionally k'_{leg} was underestimated (-23.6%) to k_{leg}. This result represents that the bias of k'_{leg} affected to accuracy of the individual values; however the tendency in the group of children could be validated because of the high relationship between variables in Morin’s estimation and gold standard method. From the above, we concluded that Morin’s method may be able to estimate vertical stiffness and leg stiffness in children, although vertical and leg stiffness tended to be underestimated.

P-2-5 The relationship between birth month, physical fitness, motor ability and evaluation from kindergarten teachers for young Japanese children

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The cognitive and physical development of slightly older children can be up to 364 days more advanced compared to that of slightly younger children. This phenomenon is called the “relative age effect,” which is defined as the consequence of age differences between individuals within the same cohort, either in school or on sports teams (Musch & Grondin, 2001). In Japan, the relative age effect has been confirmed for physical fitness and motor ability (Kawata et al., 2012). Meanwhile, a relationship between evaluation and motor ability from kindergarten teachers among young children has been reported (Kamimura et al., 2013). In other words, the development degree caused by birth month has an indirect or direct relationship to those elements. Therefore, the study purpose here was to examine the relationship between birth month, physical fitness, motor ability and evaluation from kindergarten teachers among Japanese young children using causal estimation model.

We collected the data from 329 children (160 four-year-old children: 76 males and 84 females; 169 five-year-old children: 85 males and 84 females) in July 2011. Ten teachers in charge of the children’s kindergarten classes completed questionnaires. We investigated the children’s physical fitness (height, weight, and sitting height), motor ability (20 m sprint, standing broad jump and softball throwing), and evaluated children’s physical activity according to the kindergarten teachers’ questionnaire responses.

The causal estimation model using the covariance structure analysis (maximum-likelihood method) examined each grade. In the class of four-year-olds, despite a significant scaled chi-square difference (X^2= 126.19, df = 78, p < 0.001), there was a good fit to the model (goodness of fit index = 0.938, adjusted goodness of fit index = 0.894, comparative fit index = 0.967, root mean square error of approximation = 0.043). The standardized path coefficients in most items were higher than 0.3 and were significant (Figure 1).

In the class of five-year-olds, despite a significant scaled chi-square difference (X^2 = 126.19, df = 78, p < 0.001), there was a good fit to the model (goodness of fit index = 0.938, adjusted goodness of fit index = 0.894, comparative fit index = 0.936, root mean square error of approximation = 0.043). The standardized path coefficients in most items were higher than 0.3 and were significant (Figure 2).

The results suggest that birth months affect the evaluation of children’s physical activity through their physical fitness and motor ability.

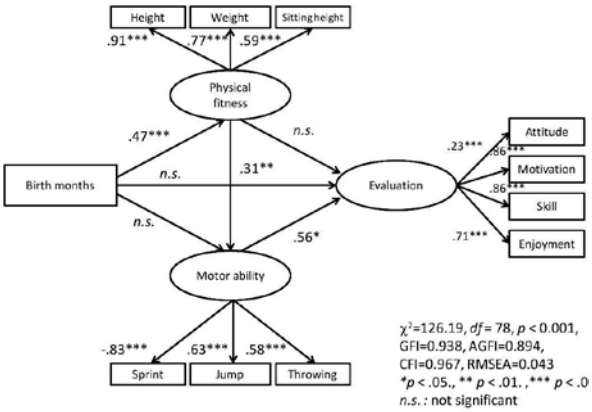

Figure 1. The causal estimation model (4-year-old class)

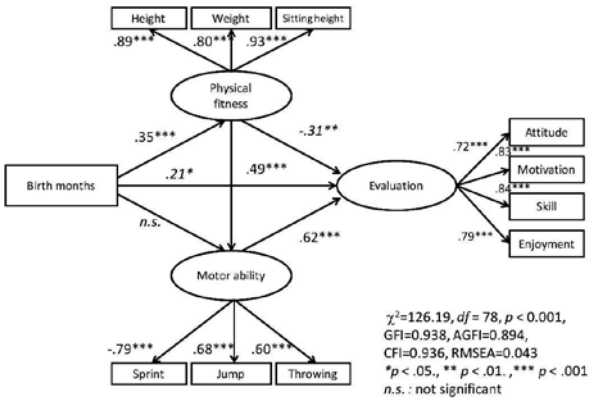

Figure 2. The causal estimation model (5-year-old class)

P-2-6 Physical activity of children and adolescents in medium city in China

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BACKGROUND: A rising prevalence of childhood obesity has been seen worldwide. An important strategy in order to achieve healthier body composition is to encourage a lifetime physical activity (PA) participation in overweight or obese children (WHO, 2004). The purpose of this study is to compare the association between PA and obesity of children and adolescents in Chinese children, and to identify factor that influence the PA levels and obesity in Chinese children.

METHODS: This was a cross-sectional study conducted in 2013 in a school setting with 962 Chinese children and adolescents aged 12-16 years (age 14.9±0.9). The children and adolescents consisted of normal-weight children (NW); overweight children (OW) and obese children (OB) who determined by BMI according to working group of obesity in China cut offs. The children and adolescents were recruited to complete anthropometric measurement and standardized PA questionnaire. Other confounding variables such as parents' demographic information, lifestyle factors were also collected through questionnaire.

RESULTS: A total of 885 valid children and adolescents data were collected. The prevalence of obesity was 8.8% (boys: 9.9%, girls: 7.5%) for junior high-school student (JS) and 7.8% (boys: 12.7%, girls: 4.3%) for high-school student (HS). The prevalence of unachieved the recommended level of 60 minutes of moderate to vigorous PA (MVPA) every day was, in boys, 64.7%(NW) 63.6%(OW) and 76.0%(OB) for JS, 70.7%(NW), 72.7%(OW) and 81.5%(OB) for HS, in girls, 77.0%(NW), 80.0%(OW) and 71.4% (OB) for JS, 91.1%(NW) 90.9%(OW) and 90.9%(OB) for HS, respectively. The percentage of screen time that more than 2 h a day was, in boys, 17.1% (NW), 24.2%(OW), 28.0%(OB) for JB, 17.5%(NW), 28.4%(OW), 35.2%(OB) for HS, in girls, 20.1%(NW), 18.0%(OW), 35.7%(OB) for JS, 13.6%(NW), 21.6%(OW), 36.4%(OB) for HS, respectively. Regardless of the gender and weight statue, the probabilities of achievements of HS were less than JS. Moreover, boys were more PA, watched less television and used computer less often than did girls. OW and OB children were less PA, watched more television and used computer more often than NW children.

CONCLUSION: The fact that children and adolescents consistently failed to meet established PA recommendations, supporting that age-related declines in PA. In this study, highlight the importance of promoting PA to children and adolescents, especially OW and OB children and adolescents.

P-2-7 The relationship between toe grip strength and physical fitness in elementary school children

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INTRODUCTION: Toes are the only parts of the body connected to the ground, providing both tactile and pressure information through the plantar afferents, somatic sensation through these organs is also very important for various movements, including standing and walking. In particular, the toes control whole body posture and movement, and can generate propulsive force during walking and prevent forward falls. Toe function has been often represented as toe grip strength in various studies. Some investigators have found that low toe grip strength (TGS) is an important risk factor for falls among elderly individuals (Endo et al. 2002). The other side a decrease in children's physical strength and athletic ability has become a problem in recent years. The present study was aimed to reveal the relationship between TGS and physical fitness in elementary school children.

METHODS: From first to sixth grade 274 primary school children (men=133, women=141) were participated in this study. TGS was measured using a toe grip dynamometer (Takei Scientific Instruments, japan). Physical performance was evaluated using MEXT's physical fitness tests (Grip strength, sit-up, long seat type anteflexion measurement, side-steps, multi-stage fitness test, 50-meter run, standing long jump, softball throw), manual muscle test(MMT)(Knee extension torque, knee flexion torque, hip extension torque and Hip flexion torque) and Jumping height (Rebound jump(RJ), squat jump(SQJ), counter movement jump(CMJ)). The correlations for mean TGS between boys and girls were calculated using Peason's correlation coefficient. To assess relationships between mean TGS and the selected parameters, we calculated Pearson's correlation coefficient by sex and conducted a stepwise multiple regression analysis that included physical characteristics, physical fitness and muscle strength as explanatory valuables. For all tests, statistical significance was set at $p<0.05$.

RESULTS AND DISCUSSION: Toe grip strength was significantly increased after the third grade in comparison to the first grade for both genders ($p<0.01$). It was observed that muscle strength of elementary school children increases with growth. It tended boys higher than girls, however, was not significant gender differences in all of grade. In both genders, TGS was significantly correlated with MEXT's physical fitness tests ($p<0.01$), MMT ($p<0.01$) in all of the items and boys SQJ ($p<0.01$) and CMJ ($p<0.01$) and girls RJ ($p<0.05$). The stepwise multiple regression analysis revealed that boys height ($p<0.01$), knee extension torque ($p<0.01$) girls weight ($p<0.01$), hip flexion/extension torque ($p<0.01$) and both genders grip strength ($p<0.01$), knee flexion torque ($p<0.01$) were associated with TGS. TGS was increased with the growth particularly for the affected height and weight, therefore it was analyzed eliminate the effect of height and weight. The grades were not significantly correlated between the grades for both genders. The stepwise multiple regression analysis revealed that boys knee extension torque and softball throw, girls hip extension torque, standing long jump and grip strength have been selected as the independent variable were associated with both of body weight correction TGS and height correction TGS. Knee extensor strength and hip extensor strength are widening the stride, help to make a walking or running in a large stride. Toe grip strength has been reported to perform the functions push the body forward during walking or moving and by strengthening the power of the walking speed and the running speed to be improved. From these, the TGS stronger person is considered that it is possible to push out to a more forward body and to stabilize the waist.

P-2-8 Changes in the physical fitness of Taiwanese school children in Japan: A cross-sectional study

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INTRODUCTION: The physical fitness level of Taiwanese junior high-school students was lower than junior high-school Japanese students from our previous report. But It is not clear about the physical fitness status of Taiwanese elementary school children living in Japan. Therefore, the purpose of this study is to survey the changes in the physical fitness of Taiwanese school children in Japan and to compare their physical fitness level with Japanese school children in Japan.

METHOD: The subjects were Taiwanese school children (T) (n=100) in 10 to 14 year old boys and girls. The test battery consisted of height, weight, seating height, grip strength, 30-seconds sit-ups, sit and reach, jumping side to side, 50-meter dash, standing long jump, softball or handball throw and 20m PACER. These data are compared with the research report of physical fitness of children of Kanagawa Prefecture in 2013 (K).

RESULTS: The result of boys in T was higher than K in height (about 4% in children 12 years old), weight (about 28% in children 12 years old), and 30-seconds sit-ups (about 16~29% in children 10, 11, 14 years old) ($p<0.05$). The result of boys in T was lower than K in 50-meter dash (about 14% in children 12 years old), and 20m PACER (about 26~33% in children 11, 12, 14 years old), but the total fitness composite score did not significantly differ on the T and K. The result of girls in T was higher than K in 30-seconds sit-ups (about 24% in children 10 years old) and jumping side to side (about 15% in children 10 years old) ($p<0.05$). The result of girls in T was lower than K in weight (about 11% in children 13 years old), 50-meter dash (about 12% in children 14 years old), standing long jump (about 16% in children 14 years old), handball throw (about 28~29% in children 13, 14 years old), and 20m PACER (about 30~41% in children 13, 14 years old) ($p<0.05$). Furthermore, the total fitness composite score was significantly different on the T and K (in children 14 years old).

CONCLUSION: The physical fitness level of Taiwanese elementary school children is similar to Japanese elementary school children in boys and girls, but the difference of physical fitness between Taiwanese school children and Japanese school children increases with increasing grade in girls. It is presumed that differences of extracurricular activity participation could affect their fitness level.

P-3-1 Polymorphism in the CNTF receptor gene is associated with elite Japanese endurance athlete status: a case-control study

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INTRODUCTION: Ciliary neurotrophic factor (CNTF) is a protein that promotes the differentiation and survival of a wide range of neuronal cell types and signals through its receptor (CNTFR) thereby regulating neuronal and muscle growth.

PURPOSE: To examine the association between CNTFR gene polymorphism and elite Japanese endurance-athlete status.

METHODS: 209 endurance/middle-power athletes: EMA (middle- and long-distance runners) and 814 Japanese controls were genotyped for C/T polymorphism of 3'-UTR of the CNTFR gene by use of TaqMan Genotyping Assay. All athletes were national (n = 143) or international (n = 66) level and the group included several medalists at the international competitions such as Olympic Games.

RESULT: Genotype distribution of C/T polymorphism in EMA (CC: 40, CT: 48, and TT: 12%) and controls (CC: 52, CT: 40, and TT: 8%) were in Hardy-Weinberg equilibrium. TT+CT genotype frequency was higher in EMA than controls under the T-allele-dominant model (P = 0.0015, OR: 1.64 [95% CI: 1.21 - 2.24]). When EMAs were divided into 2 groups: national (N) and international (I) athletes, the TT+CT genotype frequency was higher than controls only in I-EMA under the T-allele-dominant model (P = 6e-04, OR: 2.49 [95% CI: 1.45 - 4.28]).

CONCLUSION: The association found between the C/T polymorphism of 3'-UTR of the CNTFR gene and elite Japanese athlete status is of interest and worthy of further study in other elite athlete cohorts.

P-3-2 The relationship between alpha-actinin-3 gene R577X polymorphism and muscle flexibility

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Muscle flexibility is a component of physical fitness. It is suggested that genetic factor affects individual muscle flexibility, however, the relationship between alpha-actinin-3 gene (*ACTN3*) R577X polymorphism and muscle flexibility is unclear. The purpose of this study was to investigate an association between *ACTN3* R577X polymorphisms and muscle flexibility in Japanese.

In this study, 776 people (208 men and 568 women, 23–88 years old) were included. All subjects answered a questionnaire about exercise habits, and were subjected to a battery of tests to assess their fitness status (including grip strength and sit and reach). Genotyping was performed using the TaqMan approach for the *ACTN3* R577X polymorphism (rs1815739).

The genotype frequencies of the *ACTN3* R577X polymorphism in men (RR, 24.5%; RX, 52.9%; XX, 22.6%) and women (RR, 19.9%; RX, 52.6%; XX, 27.5%) were in the Hardy–Weinberg equilibrium (men, $P = 0.402$; women, $P = 0.160$). In men, there were no differences in age, height, weight, BMI, grip strength, and sit and reach among genotypes. In contrast, the sit and reach flexibility in the RR genotype (36.1 ± 0.9 cm) was significantly lower than that in the RX and XX genotype (38.9 ± 0.4 cm) even after statistically adjusted by age and exercise habit as covariates in women ($P < 0.01$).

In conclusion, *ACTN3* R577X genotype was associated with muscle flexibility assessed by sit and reach test in women. RR genotype had lower muscle flexibility than RX and XX genotype.

P-3-3 Association between the combination of ACTN3, ACE, IGF2 gene polymorphisms and judo status

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Single gene polymorphism, in particular alpha-actinin-3 (ACTN3) and angiotensin converting enzyme (ACE) gene, is associated with sports performance, muscle strength and athletic status. Moreover, we have demonstrated associations between insulin-like growth factor 2 (IGF2) and judo status and back muscle strength. There is a possibility that the combinations of many genetic polymorphisms are more effective than alone. We have recently found that the combination of IGF2 and ACE gene may be the candidate combination of genetic polymorphism associated with judo status. However, to date, there is no report of an association between the combination of three gene polymorphisms and sports performance. Accordingly, the purpose of this study was to evaluate the association between the combination of ACTN3, ACE and IGF2 gene polymorphisms and judo status.

The subjects included 156 male judo athletes belonging to top-level universities in Japan. They were divided into three groups based on results in national or international competitions. Sixteen athletes were classified as “international level”, 37 as “national level”, and 103 as “others”. DNA was extracted from their saliva and genotyping using PCR-RFLP was conducted to detect ACTN3 (rs1815739), ACE (rs1799752), and IGF2 (rs680) gene polymorphisms. Controls were individuals of known genotype from the general population as reported in previous studies (ACTN3-Controls, n = 1191; ACE-Controls, n =5679; IGF2-Controls, n = 167).

There was a higher frequency of the ACTN3 RX, ACE II and IGF2 GG genotype in all the judo athletes (10.3%) compared with that in the controls (1.2%). There was a lower frequency of the ACTN3 RX, ACE ID and IGF2 AA genotype in all the judo athletes (1.9%) compared with that in the controls (8.9%). Two of the 156 judo athletes were ACTN3 RX, ACE DD and IGF2 GG genotype and they are international-level athletes.

The combination of ACTN3, ACE and IGF2 gene polymorphisms may influence judo status.

P-3-4 Long term effect of cardiorespiratory fitness for a prevention against diabetes

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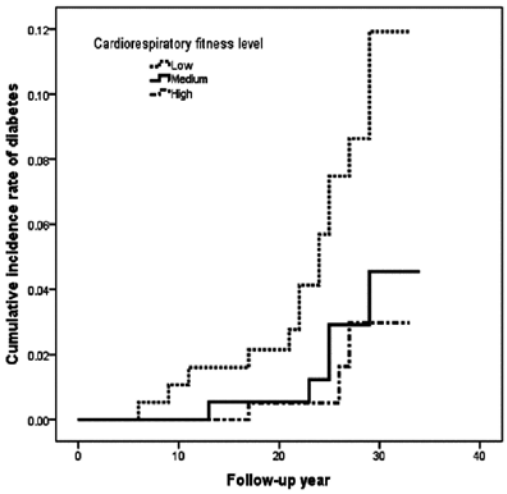
In Japan, although the prevalence of overweight (BMI ≥ 25), the strongest predisposing factor for type 2 diabetes, is low compared with that in Europe and the United States, the prevalence of type 2 diabetes has increased over the last 15 years. In epidemiological studies of both Japanese and Caucasian population, a high level of cardiorespiratory fitness has been shown to be a protective factor against type 2 diabetes. However, there are no reports focused specifically on athletes that investigate whether high cardiorespiratory fitness at a young age can prevent disease later in life. Therefore, the present study examined the relationship between cardiorespiratory fitness at a young age and the development of type 2 diabetes in Japanese athletes using a cohort study.

Between 2007 and 2009, 3,539 male alumni who graduated at the physical education department, were mailed a follow-up questionnaire about their diabetes background and 1,385 male alumni returned it. The cardiorespiratory fitness of male alumni, as measured by stored data of a 1,500-m endurance run in college (1971–1991) was available for 41% of the respondents. In the present study, we analyzed for 570 male alumni by Cox's proportional hazards models and adjusted for age, year of graduation, BMI, smoking, and sports club participation at college age.

This study covered a 26-year follow-up period (Interquartile Range: IQR: 23–29 years), and median age at the follow-up questionnaire was 49 years (IQR: 45–52 years). At follow-up, 22 men had developed type 2 diabetes. The incidence of type 2 diabetes was inversely correlated with cardiorespiratory fitness, and the low cardiorespiratory fitness level increased the cumulative incidence rate of type 2 diabetes (Figure). There were progressively lower age-adjusted relative risks of type 2 diabetes across cardiorespiratory fitness levels (p =0.01 for trend). After adjustment for age, year of graduation, BMI, smoking, and sports participation, hazards ratio and 95% CI by category (low, medium, and high) were 1.00 (reference), 0.40 (0.14–1.13) and 0.26 (0.07–1.00) (p = 0.03 for trend).

We conclude that cardiorespiratory fitness at a young age can predict type 2 diabetes later in life even among Japanese male athletes.



(Extract from Someya et al. BMC Public health, 2014)

P-3-5 Relationship between physical activity during pregnancy and mood changes after delivery in Japanese women

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To assess the association between physical activity during pregnancy and mood changes after delivery, we surveyed 107 pregnant women who had a normal vaginal delivery in the Gynecological Department of Juntendo University Hospital. The study participants completed a structured questionnaire four times, viz. at 12, 25, and 36 weeks' gestation and at 1 month after delivery. The first three questionnaires focused on physical exercise activity in the most recent 4 weeks. The forth questionnaire focused on mood changes, assessed by the Edinburgh Postnatal Depression Scale (EPDS), Profile of Mood States (POMS), and Visual Analog Scale fatigue score (VAS). In total, 12.9%, 29.8%, and 34.6% of the participants engaged in physical activity at 12, 25, and 36 weeks' gestation, respectively. By contrast to the observation of decrease in women exercising from the second to third trimester (ref. 1), the proportion of participants exercising increased from the 12th to 36th week of gestation in the present study. This discrepancy was probably due to the differences in socio-demographic characteristics of participants in the two studies. There were no differences in EPDS and VAS between women who had been physically active and inactive at 12, 25, or 36 weeks' gestation. The results of the POMS showed that although there were no differences between women who were active and inactive at 12 and 25 weeks' gestation, the "Vigor" scale was significantly higher ($p < 0.05$) and the "Fatigue" scale was significantly lower ($p < 0.05$) in women who were physically active at 36 weeks' gestation than in women who were inactive at the same time. These results suggest that even if women do not engage in physical activity during the first or second trimester, physical activity during the third trimester may improve the mood after delivery.

Reference

(1) Haakstad, Lene AH, et al. "Why do pregnant women stop exercising in the third trimester?" Acta obstetricia et gynecologica Scandinavica 88: 1267-1275, 2009.

P-3-6 Introduction of diversity fault lines as antecedent to work stress

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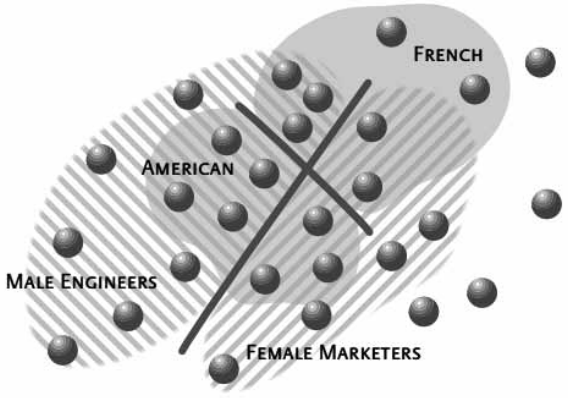
The purpose of this study is to introduce “diversity fault lines.” The term fault lines refer to hypothetical dividing lines that may split a group into subgroups based on one or more attributes. (See "Figure.") Fault line theory explains how a combination and the configuration of the attributes of team members can influence the team's behavior and ultimately its performance.

Over the past two decades, researchers have reported inconsistent findings on the relationship between diversity and outcomes. Indeed, diversity is often portrayed as a “double-edged sword” in contemporary organizational theory. Although recent meta-analyses suggest that task related diversity (i.e., work styles, values, and knowledge) may be more likely to have a positive than a negative association with performance, while demographic diversity (i.e., gender, age, and nationality) may be more likely to be negatively related to performance.

It is clear that managing people from different backgrounds, with wide ranging aspirations and experience, of different gender and ages has brought symbolic benefits to organizations. In fact, companies create diverse teams to tackle complex challenges and tasks across boundaries, functions, and geographies. As diversity is increasingly recognized as a key strategy for work organizations, a variety of teams in a range of different organizations such as sport associations, surgical teams, and public health teams are becoming more diverse. Participation and decision-making of women in sport has been growing especially after the Brighton Declaration. Also, team medical care has been received increasing attention, because medical technology has been getting more specialized.

Previous studies have shown a significant negative relationship between fault lines and organizational outcomes such as decreased cross-subgroup work communications, and increased conflict and turnover, with the assumption that fault lines may reduce social integration and disrupt team process and performance. However, few of them mentioned individual outcomes such as stress and well-being. Strong fault lines can create a fracture in the social fabric of the group. This fracture may become a source of tension and barrier to the creation of trust, which may be factors influencing negative impact on individuals.

We will conduct an empirical study on fault lines for the first time in Japan. To clarify the correlation between fault lines and work stress, a web-based survey will be carried out in this autumn for registered monitors of a survey company. Approximately 1,000 workers who belong to organizations will be invited to the survey including questions about the degree of the perception of work stress and diversity fault lines.



P-3-7 Relationship between assertion types and communication networks of nursing organization at university hospital

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The purpose of this study is to obtain a perspective of the communication objectively and analyze the relationship between assertion types and inter personal communications in a nursing organization of a university hospital.

Chester Barnard stressed the importance of communications for the activation of the organization. The quality of the communications is the key to success of the organization. In the medical world, it is great important matter to be connected directly with the health of the patients. To promote the communications in the nursing organization, assertive communication which enables self-expression attracts attention recently. However, in the previous studies of the assertion and communication in the nursing organization, they mainly used questionnaires, interviews and video cameras. Few studies are existed to clarify the relation with practical communication scientifically (see Figure), which is not enough to accumulate the evidence-based outcomes.

Therefore, this study visualizes the communication networks of the nursing organization scientifically with an electronic sensor and is to clarify how the index influences it with a type of the assertion.

Participants of this study were 26 nurses in a maternity ward. Through the informed consent procedure, a total of 26 nurses agreed with this study (response rate=100%, cover rate=100%).

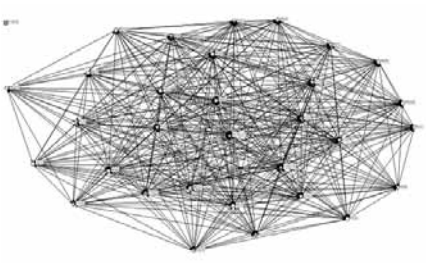
Measures of this study are electronic sensors and questionnaires. The electronic badges developed by MIT and applied by Health High-Technologies Corporation in Japan are used for measuring the communication channels and social signaling behavior of nursing organizations in university hospitals. Participants put on electronic badges for measuring the communication time at nursing organization, including formal and informal scenes for two weeks (03/11/2015-03/25). We carried out a questionnaire survey which included an assertive scale to them at the same time.

We are analyzing the results at the moment. From the analysis of these data, the following results are obtained. First, we will obtain quantity of the communications and these can visualize the communication channels of the organization. Second, we may clarify relationship and characteristics between types of the assertion and interpersonal communications by the questionnaires.

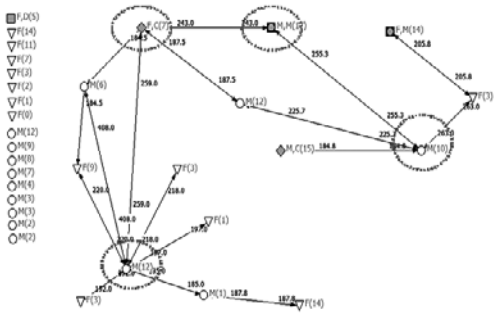
The results of this study may give some suggestions for an evaluation of activation of the practical communication. Moreover, it is not only for the nursing organization but also other organizations for building strong teams.

The limitation of this study is that implication is from only a quantitative analysis. We should investigate means and causes of this results from interview survey.

Fig.1 Example of Communication networks by the Electronic sensors (Quotation from the article of Motoki MIZUNO 2015)



More than 30min/day



More than 180min/day

P-3-8 Developing a guideline for collecting and using feedbacks in Japanese fitness club

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Recently, resilience was considered important as skill and process to adjust occupational stress. That was no exception for fitness clubs. Especially, fitness club employees provide stress full human services constantly, they face many adversities in daily operations. Hence, they are required resilience for overcome adversities to design the rich career. In this study, we stand on asserting that challenge to enhance resilience of employees is required from perspectives of career design and management. Above all, fitness clubs are required to support for enhancing resilience of employees. In the previous study, it was found that feedbacks from clients has significant influence in the process for enhancing resilience, it was required to structure a frame for collecting and managing feedbacks from the clients for supporting to enhance resilience. Therefore, we undertook to develop a guideline for collecting and using client's feedbacks. The purpose of this study was to make a draft of the guideline for collecting and utilizing client's feedbacks. Fieldworks were carried out in June of 2014. The purpose of fieldwork was to ascertain the present situation of system for collecting and managing feedbacks from clients at branches of three major fitness clubs in Japan. Moreover, we discussed with informants three times about the way to collect and use feedbacks from clients. As the result, we defined following 7 categories of a draft. 1) Promoting report of output, admiration for operation, and words of encouragement, 2) Confirming client's real intention of sharp feedback (word, expression, attitude), 3) Sharing of feedback received personally, 4) Treating negative feedback reception staff received as organizational problem, 5) Telling positive side of associate to client, 6) Moving to out of position, collecting feedbacks, 7) Using feedbacks for quantum leap. Concepts were shown that be able to work on immediately, adapt each work places. In addition, important things were very simple and needing no special cost. In the present, most feedbacks was not intentionally taken up. Positive feedbacks depend on accident and strength of relationship between clients and employees. Especially, important thing was to collect intentionally positive feedbacks. Thus, it was considered selectively how collect intentionally positive feedbacks in this study. Conclusion was followings. We suggested a draft of guideline for collecting and utilizing feedbacks from clients. It is required to verify quantitatively effect of a created guideline in this study. In addition, it is necessary that items and phrases are refined.

Table. The guideline for collecting and using feedback from clients

1	**Promoting report of outputs, admirations for operation, and words of encouragement:** If you received report or output (change of mind and body, children get ability to swim) and admiration for operation, you promote to feedback directly to concerned person. If you received warm, wished growth, and encouragement feedback, you accept honestly.
2	**Confirming client's real intention of sharp feedback (word, expression, attitude) :** If you received sharp feedback, you confirm client's real intention of sharp feedback. In many cases, clients have a different intention from their word. The opportunity is a chance for creating a good relationship.
3	**Sharing of a feedback received personally:** If you received feedback (both positive and negative), you share the feedback with any staff (it is not limited to administrator). Negative feedback is shared as problem of organization, it is necessary that the organization work out solving the problem. It is not considered as problem of individual. If administrators received consultation about negative feedback, it is required to show treating the problem as organizational problem and separating from personal evaluation.
4	**Treating negative feedback reception staffs received as organizational problem:** Reception staffs become easily contact person to receive negative feedback. Clients have a different intention even when they told directly negative feedbacks to reception staffs on the surface. It is necessary to treat negative feedbacks as organizational problem, separating from personal evaluation on such case.
5	**Telling positive side of associate to client:** If you are told negative feedbacks to associates, you have never conformed negative campaign. You are required to protect your associates when you was told negative feedback. It is very important to tell clients positive side of associates.
6	**Moving to out of your position for collecting feedbacks:** When you go to out of your working position (include cleaning, round to check a rocker rom, and helping other sections), communication increase. It is very important to go to out of your position. If you doing that, you gain many opportunities for joining gossip circle of inter clients. In addition, feedbacks are collected naturally.
7	**Using feedbacks for quantum leap:** There were many feedbacks which it bring significant growth employees. You can work out promoting to grow with negative feedbacks. Then, it is desirable to share the challenge based on feedbacks.

P-4-1 An *in vitro* contraction model in mouse primary cultured myotubes using satellite cells originated from EDL and soleus

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INTRODUCTION: Skeletal muscle cell lines such as mouse C2C12 cells and rat L6 cells often show abnormal characteristics because of repeated-passage cultures and artificial culture conditions, while primary myotubes are considered to retain their *in vivo* properties. Murine primary myotubes have been used primarily for studying the proliferation of satellite cells for muscle regeneration. However, to the best of our knowledge, they have neither been used for muscle biochemical or metabolic studies as a useful alternative to the cell lines mentioned above nor been applied to an *in vitro* contraction model. Given their properties, murine primary myotubes should be a powerful tool as an alternative to cell lines. In this study, we purely differentiated mouse primary myotubes using satellite cells originating from the extensor digitorum longus (EDL) or soleus muscle. The myotubes were also used in a contraction model stimulated by electric pulse.

MATERIALS AND METHODS: Satellite cells from the mouse EDL or soleus were isolated by a single-fiber isolation method. Dissected muscles were digested in a 0.2% collagenase solution at 37°C for 120 min followed by disassembling with Pasteur pipettes to split them into individual muscle fibers. The muscle fibers were digested with trypsin for 10 min and were then plated onto Matrigel-coated culture dishes supplemented with 20 ml of DMEM containing 30% FBS, 1% chicken embryo extract, 10 ng/ml of basic fibroblast growth factors and 1% penicillin-streptomycin. Three days after the plating, the cells were seeded onto 8-well Matrigel-coated rectangular plates. Two days after seeding, the culture medium was replaced with a differentiation medium containing DMEM supplemented with 5% horse serum and 1% penicillin-streptomycin. To visualize the sarcomere assemblies in the cultured myotubes, immunofluorescence staining for α-actinin was performed. For contraction, the primary myotubes were stimulated with electric pulses of 5, 10 or 15 mA at 1 Hz for 20 ms at 980-ms intervals at 37°C. To measure glucose uptake, the myotubes were incubated in Krebs-Ringer buffer (KRB) with or without 50 mU/ml insulin for 1 h, and glucose uptake was assayed using a 2-deoxyglucose uptake measurement kit. C2C12 myotubes were used for comparison with the primary myotubes.

RESULTS AND DISCUSSION: Satellite cells formed well-differentiated myotubes (primary myotubes) without any contamination by of other cells. Sarcomere assemblies were observed in the primary myotubes, but were hardly observed in C2C12 myotubes. When stimulated by a 5-mA electric pulse, most primary myotubes contracted, while only a few C2C12 myotubes contracted. The number of myotubes responding to electric pulse stimulation increased in both the C2C12 and primary myotubes as the current was increased to 10 and then 15 mA, however the movement in the primary myotubes was consistently larger than that in the C2C12 myotubes. Glucose uptake stimulated by insulin was significantly increased compared to the basal uptake in both the primary and C2C12 myotubes.

These data suggest that mouse primary myotubes, with their greater number of sarcomere assemblies and higher level of contractive activity, will be valuable as an in vitro contraction model that can be used in place of cell lines or human primary myotubes.

P-4-2 Intramyocellular lipid accumulation after high-fat diet is associated with the gene expression involved in lipid metabolism in skeletal muscle of non-obese men

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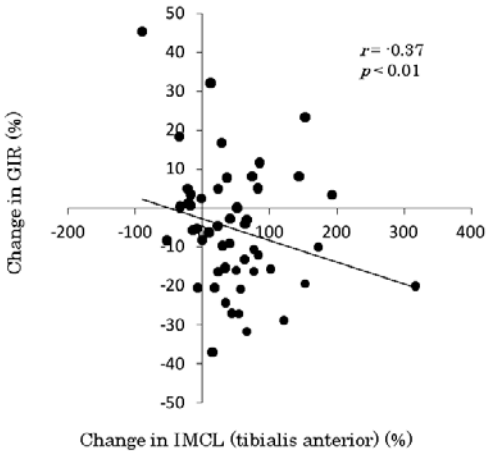
Insulin resistance in skeletal muscle is one of the main features of type 2 diabetes and metabolic syndrome. Whereas the mechanisms underlying the development of insulin resistance have not been fully elucidated, the accumulation of intramyocellular lipid (IMCL) is recognized as an important determinant of insulin resistance, and is increased by a high-fat diet (HFD). It had shown that a 3-day high-fat diet (HFD) in human increases the IMCL level and impairs insulin sensitivity in skeletal muscle. However, the effects of HFD on IMCL and insulin sensitivity are highly variable. The aim of this study was to identify the genes in muscle that are related to this inter-individual variation. Fifty non-obese healthy men were recruited for this study. Before and after HFD for 3 days, IMCL levels in the tibialis anterior were measured by 1H-magnetic resonance spectroscopy, and peripheral insulin sensitivity was evaluated by glucose infusion rate (GIR) during the euglycemic-hyperinsulinemic clamp. We observed a significant increase in TA-IMCL by HFD. GIR was significantly decreased by HFD. We also observed a negative correlation between changes in TA-IMCL and GIR by HFD ($r = -0.37$, $P < 0.01$: Figure1), Subjects who showed a large increase in IMCL and a large decrease in GIR by HFD were classified as the high-responder (HR), and the subjects who showed a small increase in IMCL and a small decrease in GIR were classified as the low-responder (LR). In 5 subjects in each group, the gene expression profile of the vastus lateralis muscle was analyzed by DNA microarray analyses. Before HFD, gene expression profiles related to lipid metabolism were comparable between the 2 groups. Gene Set Enrichment Analysis demonstrated that 5 gene sets related to lipid metabolism were up-regulated by HFD in the HR group, but not in the LR group. Changes in gene expression patterns were confirmed by qRT-PCR using more samples (LR: n = 9; HR: n = 11). These results suggest that IMCL accumulation/impaired insulin sensitivity after HFD is closely associated with changes in the expression of genes related to lipid metabolism in muscle.



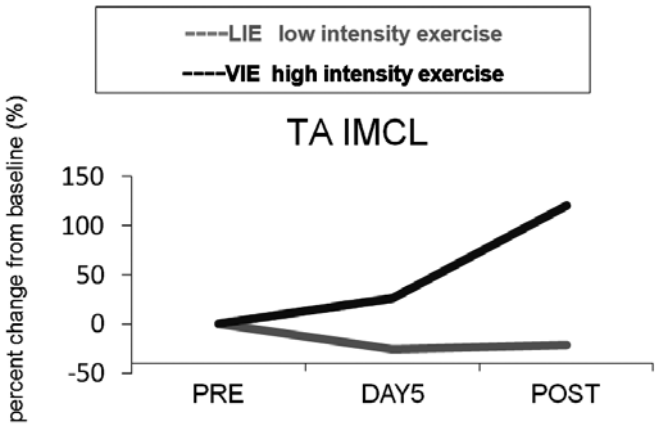
P-4-3 Role of exercise intensity on intramyocelluar lipid level after exercise in subjects with moderate insulin resistance

FUNAYAMA Takashi[1)], **TAMURA Yoshifumi**[1,2)], **TAKENO Kageumi**[1)], **KAWAGUCHI Minako**[1)], **WATANABE Takahiro**[1)], **KAGA Hideyoshi**[1)], **FURUKAWA Yasuhiko**[1)], **SUZUKI Ruriko**[1)], **YAMAMOTO Risako**[1)], **KAKEHI Saori**[2)], **FUJITANI Yoshio**[1)], **KAWAMORI Ryuzo**[1,2)], **WATADA Hirotaka**[1,2)]
Department of Metabolism & Endocrinology, School of Medicine, Juntendo University[1)]; Sportology Center, Graduate School of Medicine, Juntendo University, Tokyo, Japan[2)]

It is known that the increased intramyocellular lipid (IMCL) levels observed in obese subjects are closely associated with Insulin resistance (IR) in muscle. Interestingly, some reports suggested low intensity exercise (LIE) decreased IMCL and improved IR. On the other hand, a few reports showed vigorous intensity exercise (VIE) improved IR, but increased IMCL level. This phenomenon is a reminiscent of endurance-trained athletes, who possess a high oxidative capacity and enhanced insulin sensitivity, also have higher IMCL content known as athlete's paradox (AP). From these findings, we hypothesized exercise intensity is one of the determinants of AP.

To test this hypothesis, we recruited 20 men with moderate insulin resistance (HOMA-R >1.6) and randomly assigned to LIE (40% VO_2 peak) or VIE (70% VO_2 peak) group. Each group performed with ergometer for 5 consecutive days. Before and 3-day after completion of protocol, IR was evaluated by glucose clamp. IMCL was measured by ^{1}H-MRS. The IMCL was also evaluated immediately after the exercise at day 5. Both exercise protocol improved IR. In LIE group IMCL level was decreased after exercise at day 5 and 3-day after last bout of exercise.In VIE group IMCL level was not significantly changed after exercise at day 5. Although IMCL level was decreased at 3-day after last bout of exercise in LIE group, that in VIE group increased about 50% from baseline (Fig).

These data suggested exercise intensity is a determinant of change of IMCL.



P-4-4 Exercise-induced transient increase in IL-6 stimulates GLUT4 expression and enhances insulin sensitivity in mouse skeletal muscle

IKEDA Shin-ichi[1)], **TAMURA Yoshifumi**[2,3)], **KAKEHI Saori**[2,3)], **KAWAMORI Ryuzo**[2,3)], **WATADA Hirotaka**[2,3)]

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A single bout of exercise induces transient increase in blood interleukin-6 (IL-6) level in human and rodents, however, the role of exercise-induced IL-6 is poorly understand. Prolonged, chronic increase in IL-6 reflects low-grade inflammation, which decrease insulin sensitivity in adipose tissue, liver and skeletal muscle. On the other hand, acute, short-period of IL-6 enhances insulin sensitivity. Because, the increase in IL-6 after exercise is transient, we hypothesized that transient increase in IL-6 after exercise enhances insulin sensitivity in skeletal muscle. C57BL6J mouse were i.v. injected normal IgG or IL-6 antibody before exercise. Twenty-four hours after a single bout of exercise (treadmill running: 20m/min, 90 min with 10 degree incline), plantaris muscle was harvested and incubated in oxygenized KRB buffer to measure insulin-stimulated 2-deoxyglucose (2-DG) uptake. Compared with sedentary mouse, insulin-stimulated 2-DG uptake in plantaris muscle was increased 24 h after exercise in IgG-injected mouse, however, the increase induced by exercise was not observed in IL-6 antibody-injected mouse. Concomitant with this results, GLUT4 expression was increased 24 h after exercise in IgG-injected mouse, the increase was canceled in IL-6 antibody-injected mouse. Recombinant mouse IL-6 injection increased GLUT4 expression both fast-twitch plantaris muscle and slow-twitch soleus muscle in C57BL6J mouse. Furthermore, short period incubation of IL-6 (3-12 hours) increased GLUT4 expression in differentiated C2C12 myotubes, however long period (24 h) did not. These results suggests that exercise-induced transient increase in IL-6 affects skeletal muscle in autocrine/paracrine manner, which enhances GLUT4 expression leading to increase insulin sensitivity in skeletal muscle.

P-4-5 Potential usefulness of intrahepatic lipid accumulation and liver function tests to identify insulin resistance phenotype in non-obese type 2 diabetes

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Despite low body mass index (BMI), Asian people often develop type 2 diabetes. In addition to reduced insulin secretion, etiological difference of insulin resistance (IR) between Caucasian and Asian might be involved in this phenomenon. Previous data demonstrated that non-obese Asians easily develop non-alcoholic fatty liver disease (NAFLD) which is considered as cause and result of IR. These data suggested that intrahepatic lipid (IHL) accumulation and liver dysfunction could be markers of IR in non-obese type 2 diabetes.

To test this hypothesis, we recruited 16 non-obese (BMI<25kg/m^2) type 2 diabetes (BMI 21.9±2.0 kg/m^2, HbA1C 6.8±0.5%, Diet and exercise or take α-glucosidase only).Their diet history was evaluated by brief-type self-administered diet history questionnaire. Ten days before experimental day, regular exercise was prohibited and the mean daily physical activity level for 7 days was estimated with an ambulatory accelerometer. Then, each subject were told to keep their daily physical activity at mean daily physical activity level ± 10% during last 3days, which was monitored by an accelerometer. In the experimental day, we measured IHL by ^{1}H-magnetic resonance spectroscopy (MRS) at overnight fasting state. Total body fat content was measured by using the bioimpedance method. We also evaluated visceral fat and subcutaneous fat area by magnetic resonance imaging (MRI).

Then, we performed euglycemic hyperinsulinemic clamp to measure insulin sensitivity (IS) in muscle and liver, respectively. We also measured serum liver function tests, such as AST, ALT and γ-GTP. Based on the upper limit of normal IHL level (4%) in general non-obese Japanese cohort, we divided the subjects into low IHL group (n=11; 1.3 (0.46-2.39) %) and high IHL group (n=5; 10.3 (6.26-12.7) %).

Compared with low IHL group, high IHL group showed lower muscle IS (6.79 (5.48-7.54) mg/kg/min vs 3.87 (3.84-5.66) mg/kg/min, P=0.06), lower HDL-Cholesterol (44.2±9.12 mg/dl vs 61.9±17.0mg/dl), higher fasting insulin (6.29±3.85 μU/ml vs 3.28±1.26) and higher γ-GTP (25.3±9.1 IU/l vs 41.2±17.4 IU/l, P<0.05), while hepatic IS was comparable between the groups. Correlation analysis in all subjects revealed that IHL was not significantly correlated to IS in muscle and liver, however, all liver function tests are significantly correlated to both hepatic and muscle IS, respectively. Among them, ALT was a best predictor for IS both in muscle (r=-0.84, P<0.01) and liver (r=-0.60, P<0.05), whereas ~90% of ALT values in this study subjects were within normal limit (<40 IU/l). These data suggested that small elevation of ALT even within the normal range, rather than IHL accumulation, is a useful marker to identify IR phenotype in non-obese type 2 diabetes.

P-4-6 Effects of exercise before development of type 2 diabetes on glucose and lipid metabolism remain partly following exercise cessation in OLETF rats

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INTRODUCTION: The prevalence of obesity and lifestyle diseases has dramatically increased in not only adult but also children. As the long-term exposure to risk factors is contributed to develop lifestyle diseases, it is important to prompt to work out the primordial and primary prevention strategies from an early stage. It is widely recognized that regular exercise prevents obesity and insulin resistance in rodents and human. However, there are few experimental studies to examine whether exercise can prevent development of lifestyle diseases and contribute to the health or morbidity in later life.

PURPOSE: To investigate the effects of voluntary exercise before development of type 2 diabetes on glucose and lipid metabolism in genetically spontaneous type 2 diabetic rats.

METHODS: Thirty eight male Otsuka Long-Evans Tokushima Fatty (OLETF) rats as an animal model of type 2 diabetes and nine their counterparts (Long-Evans Tokushima Otsuka; LETO) were used. LETO rats were kept sedentary during the experimental period. OLETF rats were divided into three groups, respectively: sedentary (Sed, n = 11), voluntary exercise (VE, n = 10), VE-Sed (n = 8) or Sed-VE (n = 8) group. VE and VE-Sed groups were allowed to access a running wheel freely from 5 week-old. Running wheel in VE-Sed group was locked from 15 to 25 week-old and rats could not run in the wheel, whereas Sed-VE group were allowed to access the wheel from 15 to 25 week-old. At 25 week-old, an intraperitoneal glucose tolerance test (IPGTT) was performed. Five days after IPGTT, blood samples were collected and serum lipid parameters were measured.

RESULTS: Voluntary exercise suppressed a gain in body weight in OLETF rats regardless of the periods when exercise was performed. The body weight in VE-Sed group, however, was gradually increased after exercise cessation by locked a running wheel. In addition, IPGTT confirmed that glucose tolerance was impaired in the sedentary OLETF rats and normalized by voluntary exercise in VE and Sed-VE groups. In the VE-Sed group, however, the cessation of exercise exacerbated glucose tolerance but still remain better glucose tolerance compared with the sedentary OLETF rats. The concentrations of total cholesterol, triglyceride and leptin were higher in the sedentary OLETF rats than in the LETO rats, and voluntary exercise decreased to the similar levels observed in LETO rats. Interestingly, no significant differences were found among VE, VE-Sed and Sed-VE groups, suggesting that the effects of voluntary exercise remained, at least for 10 weeks, after the cessation of exercise. The non-esterified free acid (NEFA) level was significantly greater in the sedentary OLETF rats than in the LETO rats, and voluntary exercise decreased to lower levels than LETO rats. The NEFA levels in VE-Sed and Sed-VE groups were also lower than in the sedentary OLETF rats and remained to similar levels with LETO rats. Moreover, the concentration of adiponectin was significantly greater in VE and Sed-VE groups compared with the other groups, suggesting that the adiponectin levels might be influenced by the most recent exercise.

CONCLUSIONS: Our results confirmed that exercise prevents the development of impaired glucose tolerance and the abnormality of lipid metabolism in grown-up type 2 diabetic rats regardless of the periods when exercise was performed. Importantly, the effects of voluntary exercise on lipid metabolism remained following the long-term exercise cessation.

P-4-7 Caffeine increases contraction-stimulated 5'-AMP-activated protein kinase activity and insulin-independent glucose transport in rat skeletal muscle

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INTRODUCTION: 5´-AMP-activated protein kinase (AMPK) is a key mediator of contraction-stimulated insulin-independent glucose transport in skeletal muscle. We demonstrated previously that caffeine and caffeic acid, both of which are the major constituents of coffee, acutely stimulate AMPK activity and glucose transport in resting rat skeletal muscle. However, it is unknown whether caffeine and caffeic acid affect AMPK activity and glucose transport in contracting muscle. In this study, we examined the effect of caffeine stimulation on contraction-stimulated AMPK activity and glucose transport.

METHODS: (1) Male Sprague-Dawley rats (150–160 g) were sacrificed by cervical dislocation, and the epitrochlearis muscle was removed and preincubated in alpha minimum essential medium (αMEM) for 40 min and then incubated in fresh medium in the absence or presence of 3 mM caffeine or 1 mM caffeic acid for 30 min. Electrical stimulation (ES) was used to evoke ten repeated 10 s tetanic contractions during the last 10 min of the incubation period. (2) Next, rats were given an intraperitoneal injection of caffeine (60 mg/kg body weight) or saline, and the extensor digitorum longus (EDL) muscle was dissected 15 min later. Rats were anaesthetized with intraperitoneal administration of pentobarbital sodium, and then ES of the sciatic nerve was performed to evoke tetanic contractions for 5 min before dissection. The muscles were then used for the measurement of 3-*O*-methyl-$_D$-glucose (3MG) transport or caffeine transport assay, or were immediately frozen in liquid nitrogen and subjected to Western blot analysis and assays to measure isoform-specific AMPK activity, and ATP and phosphocreatine (PCr) content.

RESULTS: (1) The combination of caffeine plus contraction additively increased the phosphorylation of AMPKαThr^{172},α-isoform-specific AMPK activity, and 3MG transport. Caffeine significantly delayed muscle fatigue during contraction, and the combination of caffeine plus contraction partially additively decreased ATP and PCr contents. In the caffeine transport assay, the intracellular concentration of caffeine reached a maximum by 30 min after the start of the exposure to caffeine, and was not affected by contraction. Unlike caffeine, incubation with caffeic acid did not affect the contraction-stimulated AMPKα Thr^{172} phosphorylation. (2) Similar to the findings from isolated muscles incubated *in vitro*, the combination of caffeine plus contraction *in vivo* had additive effects on AMPKαThr^{172} phosphorylation, α-isoform specific AMPK activity, and 3MG transport. (3) Ca^{2+} has been also implicated in the activation of glucose transport through signaling pathways involving AMPK. Ca^{2+}/calmodulin-dependent protein kinase II (CaMKII) has been used as an indicator of elevated cytosolic Ca^{2+} level in skeletal muscle. The combination of caffeine plus contraction additively increased the phosphorylation of CaMKII Thr^{286} both *in vitro* and *in vivo*.

CONCLUSION: These findings suggest that caffeine and contraction synergistically stimulate AMPK activity and insulin-independent glucose transport, at least in part by elevating Ca^{2+} level and decreasing muscle fatigue, and thereby promoting energy consumption during contraction. We suggest that the ergogenicity of caffeine may contribute to the enhancement of the effect of exercise-induced promoting glucose metabolism by induction of profound activation of AMPK.

P-5-1 The exercise therapy decreases the serum interleukin-6 levels in patients with knee osteoarthritis

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PURPOSE: Exercise is one of the established treatment method for knee osteoarthritis (OA). However, the mechanisms of its action is not fully understood. Although exercise has a muscle strengthening effect that may improve the stability of the knee joint, it has been speculated that exercise may exert anti-inflammatory effect for the joint. The aim of this study was to examine whether exercise had the anti-inflammatory effects for the joint in clinical practice using biomarkers for inflammation.

METHODS: This study was approved by the Ethics Committee of our university and conducted in accordance with the declaration of Helsinki. The written informed consent for this study participation was obtained from all subjects. A total of one-hundred twenty postmenopausal women with medial type of primary knee OA (K/L2-4) who first visited our outpatient clinic for knee pain were included in the study. Subjects were randomized to either the exercise therapy group or the control group. The patients in the exercise therapy group conducted three different kinds of home exercise and stretching. The patients in the control group took either the oral selective COX2 inhibitor (celecoxib, 200mg/day for 12 weeks) or the intra-articular injection of hyaluronic acid (HA, high molecular weight 2700kDa HA, 5 times with one week interval). Age, body mass index (BMI), Japanese Knee Osteoarthritis Measure (JKOM) score, visual analog scale (VAS) for pain score and serum levels of biomarkers for inflammation (high-sensitivity C-reactive protein [hs-CRP] and interleukin [IL]-6) were evaluated at baseline and 12 weeks after treatment initiation. Values in each group were compared between baseline and 12 weeks using a paired t-test.

RESULTS: The sixty-nine of 120 patients were assigned to either the exercise therapy group and the remaining fifty-one patients were to the control group. During the twelve weeks of examination, twelve patients in the exercise therapy group and the eight patients in the control group were withdrawn. No significant differences of the baseline characteristics were observed between the exercise therapy group and the control group. The JKOM score ($p<0.001$ and $p<0.001$, respectively) and VAS score ($p<0.001$ and $p<0.001$, respectively) at 12 weeks of the patients with both the exercise therapy and control groups were significantly reduced in comparison to those at baseline. The hs-CRP levels remained unchanged in patients with both groups ($p=0.267$ and $p=0.137$, respectively). The sIL-6 levels of the patients in the exercise therapy group were significantly decreased ($p=0.021$) in comparison to those of the patients at baseline, but sIL-6 levels of the patients in the control group were not.

CONCLUSIONS: The serum IL-6 levels in patients with OA were significantly reduced by the exercise therapy, while sIL-6 levels were unchanged by NSAID, suggesting that exercise therapy may exert anti-inflammatory effects in knee OA.

P-5-2 The effect of cooling on muscle strength and muscle cross-sectional area during detraining

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Two weeks of detraining produces 6.4% of muscle atrophy even after long-term strength training. Thus, to maintain the training effect, preventing the muscle weakness and muscle atrophy caused by detraining would be valuable. Exposure to cold stimulus by cold water inhibits muscular atrophy.

The purpose of this study was to investigate the effect of cooling by ice bag on muscle weakness and muscle atrophy caused by detraining.

Six healthy males (23.0±2.5 y/o) performed elbow flexion resistance training three times per week for 6weeks. After the 6weeks training, the subjects were instructed to limit upper arm activity within their activity of daily living level during three weeks of detraining period. During the de-training period, one of the arms was cooled at inside of upper arm by an ice bag for 30min a day (ICE), and the other arms was control condition (CON). The measurements were elbow flexion torques at angular speeds of 60 and 120deg/s under concentric contraction (CC60, CC120) and isometric contraction (IM), cross-sectional area (CSA) and circumference of the upper arm. The measurements were done, at pre-training (PRE), post-training (POST), after the first week (D1), second week (D2) and third week (D3) of detraining.

IM significantly increased after training in both conditions ($p<0.05$). Significant decreases of IM in CON was observed at D2 (66.6±17.4N•m) compared to POST (78.8±24.8N•m) ($p<0.05$). Circumference significantly increased after training in both conditions (CON: 102.1±1.0%, ICE: 101.4±0.7%) ($p<0.05$). Significant decreases of circumference in CON was observed at D3 (29.6±3.4cm) compared to D2 (29.8±3.5cm) ($p<0.05$). CSA significantly increased after training in both conditions (CON: 108.5±3.3%, ICE: 107.9±2.2%) ($p<0.05$). CSA significantly decreased after the detraining in both conditions. However, there was no significant difference in all of measurements between CON and ICE.

Only IM increased after the training. It may be because of the fact that the training was composed of isometric contraction. Even though increased the muscle force, circumference and CSA by the training decreased by the detraining. On the other hand, there was no decrease in IM and circumference in ICE during detraining period. This result suggests the possibility that the cooling prevents muscle weakness and muscle atrophy; however, there was no significant difference between both conditions, therefore we consider that the effect of cooling was weak. In conclusion, the cooling for 30min a day shows possibility that the cooling prevents muscle weakness and muscle atrophy caused by detraining.

P-5-3 Morphological profiles of the quadriceps femoris of varsity athletes

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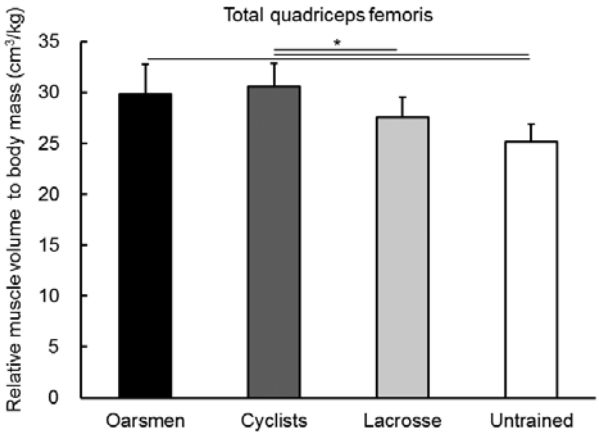
INTRODUCTION: Sport athletes often show event-related muscular profiles that are possibly associated with their competitive and training activities. Thus, investigation of the muscular profiles in athletes can enlighten the association between muscle-specific hypertrophy and sport-specific movement performance. With respect to the movement of the lower extremities, rowing and pedaling mainly consist of repetitive multi-joint leg extensions (simultaneous extensions of knee and hip joints), which are largely contributed by the quadriceps femoris. On the other hand, several types of joint motions are involved in field sports. It is hypothesized that the quantitative profiles of the quadriceps femoris are similar for the athletes who routinely repeat leg extensions (oarsmen and cyclists) but not for the athletes not regularly performing leg extensions (field sport athletes; such as lacrosse players). This study tested the hypothesis.

METHODS: T1-weighted MR images of the whole right thigh were obtained from 14 varsity oarsmen, 8 male cyclists, 13 male lacrosse players and 10 untrained men. The anatomical cross-sectional areas (ACSAs) from the origin to insertion of each muscle of the quadriceps femoris (vastus lateralis, vastus medialis, vastus intermedius, and rectus femoris) were measured. The muscle volume of each muscle was determined by summing in-series ACSAs which were multiplied by the slice thickness (1 cm), and the relative muscle volume to body mass (normalized volume) was calculated.

RESULTS AND DISCUSSION: The normalized total volumes of the quadriceps femoris were significantly greater in the oarsmen and cyclists than in the untrained men, and that of the cyclists was significantly greater than that of the lacrosse players. Likewise, the normalized vastus lateralis volumes of the oarsmen and cyclists were significantly greater than those of the lacrosse players and untrained men, and the normalized volumes of the vastus medialis and vastus intermedius were significantly greater in the oarsmen and cyclists than in the untrained men. In contrast, the normalized rectus femoris volume of the lacrosse players was greatest of the four groups, while no statistical differences were shown among the other three groups. It was made clear that the varsity oarsmen and cyclists had hypertrophied monoarticular vasti (lateralis, medialis, and intermedius), whereas the lacrosse players had hypertrophied biarticular rectus femoris. These results strongly suggest that the varsity athletes demonstrate muscle-specific hypertrophy among the synergistic muscles comprising a muscle group, depending on the sport-specific motions involved during competitive and training activities



P-5-4 The site-specific associations between the meniscus changes and the osteophyte formations in early-stage knee osteoarthritis

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PURPOSE: We recently reported that the degeneration and destruction of femoral articular cartilage and osteophytes showed a greater degree of deterioration than those of the tibial and patellar articular side in early-stage of knee OA using 3TMRI and T2 mapping sequence (Osteoarthritis Cartilage, 2014). In the present study, we focused on the meniscus change and osteophyte formation in early-stage knee osteoarthritis (OA). We examined whether there were any associations between the meniscus changes and the osteophyte formations, and also examined, if so, there were any site-specific differences for the associations in early-stage knee OA by using the magnetic resonance imaging (MRI)-based analyses.

METHOD: A total of 50 patients (mean age 59.7 years) who visited our out-patient clinic for knee pain between May and December 2012 were enrolled in this study. The severity of knee OA was classified by Kellgren-Lawrence (K/L) grading scale based on standing extended-knee X-ray images. All patients showed either K/L grade 0, 1 or 2, and were also performed 3TMRI for the affected knee. Diagnosis of knee OA for the subjects with K/L 0 was conducted using 3TMRI according to the method by Shama et al (ARD 2013). Patients who showed less than 174° of femoro-tibial tibial angle (FTA) were excluded from the study.

Compartments of the knee joint was divided into 14 places of areas according to WORMS using sagittal and coronal two dimensional (2D) fat suppressed and T2 weighted image fast spin-echo sequence (TR = 5000ms, TE= 70ms, FOV 160mm, matrix = 384×307, Slice thickness = 3mm, turbo-factor = 17, Flip-angle = 150, scan time = 3:00). The severity of osteophyte and meniscus tear were semi-quantitatively evaluated according to the WORMS method. The medial meniscus extrusion distance (MMED) was also measured. Interrelationships between the osteophyte scores in medial femoral condyle (MFC) and medial tibia plateau (MTP) and the medial meniscus (MM) tear and MMED were examined.

RESULTS: The patients showed the radiographic OA severities for K/L grade 0 (n=3), 1 (n=27) and 2 (n=20), respectively. Twenty-three of fifty patients were male, while remaining twenty-seven patients were female. No significant differences of FTA were observed between the patients with three different K/L grades.

While the MMEDs were not associated with the osteophyte scores in MTP, the MMEDs were associated with the osteophyte scores in MFC ($r=0.39$, $p<0.01$). When the patients were divided into two groups in terms of the MMEDs by the cutline of 3 mm, the osteophyte scores in MFC in group 1 (MMEDs ≧ 3mm; 3.14) were significantly higher than those in group 2 (MMEDs < 3mm; 1.50)($p=0.03$). On the other hand, the MM tear scores were associated with the osteophyte scores in MTP ($r=0.32$, $p=0.03$), while those were not associated with the osteophyte scores in MFC. In addition, when the patients were divided into two groups by the presence or absence of the MM tear, the osteophyte scores in MTP of the patients with MM tear (2.86) were significantly increased in comparison to those of the patients without MM tear (0.64, $p=0.02$).

CONCLUSION: The meniscus changes (MME and meniscus tear) were associated with the osteophyte formation in early-stage of medial knee OA. The associations were site-specific, that is; the MME were associated with the osteophyte in MFC, while the MM tears were associated with osteophyte in MTP.

P-5-5 Influences of hamstring stretching on passive muscle stiffness vary between hip flexion and knee extension maneuver: A pilot study

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INTRODUCTION: Muscle injury such as muscle strain frequently occurs in the hamstring, especially in the long head of the biceps femoris (BFl). Pre-exercise stretching has been widely performed as one of the methods for preventing the hamstring muscle strain in sports. It has been reported that less flexibility of the hamstring muscle-tendon unit assessed by passive range of motion (ROM) of the hip joint increases the risk of the hamstring muscle strain. In contrast, according to some recent literature, stretching appears to have no or little protective effect for sport injuries including the hamstring muscle strain. Taken together, no consensus has been reached as to whether stretching exercise can have positive effects for prevention of sports injuries. One of the possible reasons for the discrepancies is due to the joint at which the stretching exercise and flexibility test of the hamstring are performed. Since the hamstring which comprises the BFl, semitendinosus (ST), and semimembranosus (SM) is a bi-articular muscle group, the muscles can be stretched by passive hip flexion or knee extension. Nevertheless, no study has examined the substantial effect of each of the two stretching maneuver on passive stiffness of the individual muscles, perhaps because it is impossible from a conventional evaluation of the torque-angle relationship to quantify the passive stiffness of a specific muscle. One of the methods to resolve the problem is to use ultrasound shear wave elastography which can quantify localized tissue stiffness along the principal axis of the probe. As a pilot study, we used this technique and compared passive stiffness of BFl, ST, and SM before and after an acute bout of static stretching by either hip flexion or knee extension.

METHODS: In one healthy male subject, before and after 5 sets of 90-s stretching, passive lengthening measurements where the knee or hip joint was passively rotated to the maximal range of motion (ROM) were performed. During the passive lengthening, muscle stiffness (defined as shear modulus) of each muscle was measured by using ultrasound shear wave elastography.

RESUTS: Both stretching maneuvers increased maximal ROM and decreased passive torque at a given hip joint angle. Passive muscle stiffness was prominently reduced in all of BFl, ST, and SM after passive knee extension stretching maneuver, whereas the stretching effect by passive hip flexion maneuver was pronounced in ST and SM, but not in BFl.

CONCLUSION: The present findings suggest that 1) the effects of hamstring stretching on individual passive muscles' stiffness vary between passive knee extension and hip flexion stretching maneuvers, and 2) stretching of the hamstring should be performed by passive knee extension rather than hip flexion which is commonly used as a warm-up exercise. Further research with large number of subjects is required to confirm our conclusion.

P-5-6 Hyperventilation-induced respiratory alkalosis increases the number of repetitions able to be performed during resistance training

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BACKGROUND: During intermittent high-intensity exercise, the accumulation of hydrogen ions or the resulting fall in intramuscular pH has been considered a major factor contributing muscle fatigue. Our recent study has shown that reversing the acidic muscle milieu by means of hyperventilation (HV), incurring respiratory alkalosis, implemented during recovery periods of repeated short pedaling sprints is effective in attenuating the performance decrement associated with fatigue. The present study investigated whether HV-induced respiratory alkalosis could be applied to resistance training, expecting an increased number of repetitions able to be performed with HV.

METHODS: Eleven power-trained athletes (1RM: 102.5-162.5 kg for bench press and 170.3-246.8 kg for leg press) performed 6 sets of bench press and leg press at 80% 1RM on the same day with and without HV during the last 30-s of 5-min inter-set recovery on 2 separate occasions (protocol A and B). HV was implemented before the 1st, 3rd and 5th sets for protocol A, and before the 2nd, 4th and 6th sets for protocol B ($P_{ET}CO2$: below 25 mmHg). Subjects breathed spontaneously for the entire 5-min during the alternate non-HV recovery periods. In each exercise set, lifting was continued until failure with the number of successful repetitions being recorded. Electro-goniometers were attached about the elbow and the knee joints to calculate the joint angular velocity per repetition. Blood [La^-] and pH were examined to report physiological strains of the exercises, and pH recovery resulting from HV.

RESULTS: HV increased blood pH by 0.077±0.024 before the subsequent set ($p < 0.001$). HV either increased (leg press, $p < 0.05$) or maintained (bench press) the repetitions performed compared to the number achieved during the prior non-HV set. The repetitions performed during non-HV set were always fewer compared to the prior HV set ($P < 0.005$). The sum of repetitions (protocol A + B) was greater for HV than non-HV sets in both bench press (44±10 vs. 36±10 reps, $p = 0.001$) and leg press (64±9 vs. 50±15 reps, $p < 0.001$). After the exercise, the blood [La^-] was greater (9.82±2.66 vs. 6.87±1.47 mM, $p < 0.001$) and pH was lower (7.303±0.055 vs. 7.340±0.030, $p < 0.001$) for leg press than bench press. The goniometer data are under analysis.

CONCLUSION: HV countered the reduction of repetitions associated with fatigue. The ergogenic effect was more pronounced for leg press, which imposed a greater physiological strain than bench press. The increased volume of intense training may be translated into a greater training efficacy.

P-5-7 Biomarkers for cartilage as a predictor of radiographic progression in knee in men in early forties without knee pain

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AIM: Abnormalities in type II collagen metabolism play a key role in the pathogenesis of knee osteoarthritis (OA). It has been recently revealed that the metabolic changes of the cartilage are started much earlier than age around fifty at which the symptom of knee OA has been known to be initiated worldwide. Several cartilage biomarkers have developed to be a sensitive tool to investigate the pathophysiology of the knee OA. While the pro-collagen type II C-propeptide (PIICP) is a C-terminal peptide produced in the course of the synthesis of type II collagen, the collagen type II cleavage (C2C) and cross-inked type II collagen C-telopeptide (CTX-II) are produced by the degradation of type II collagen. We previously reported using the baseline data of the Sportology Core Study in Juntendo University that the narrowing of joint space width (JSN) of the medial knee joint in men in early forties without knee pain was associated with lower serum pro-collagen type II C-propeptide (PIICP) levels. The aim of this prospective study was to investigate whether the baseline biomarkers level for cartilage can predict radiographic JSN of the medial knee joint in men in early forties without knee pain.

METHODS: This prospective study was conducted by analyzing data of the Sportology Core Study in Juntendo University Graduate School of Medicine which was started at 2012. Forty seven healthy male volunteers (41.6 y in average) who didn't have any symptoms for knee pain and experience any traumatic episodes for the knee joints were enrolled in this study. A standing, extended antero-posterior view radiograph of both knees were taken and the serum levels of pro-collagen type II C-propeptide (PIICP) and collagen type II cleavage (C2C) and urinary level of cross-inked type II collagen C-telopeptide (CTX-II) were measured at the time of study entry and at three year follow up. Radiological progression of the knee OA is defined as a JSN greater than 0.3 mm in either of the knees during 3-years of follow up.

RESULTS: Fourteen, twenty-nine and four of 47 subjects showed a K/L grade 0, 1 and 2 at baseline, respectively. When the subjects were divided into two groups by the presence or absence of the radiological progression, fourteen of 47 subjects were progressed (P group), while the remaining thirty-three subjects were not progressed (NP group). No significant differences of the sPIICP, sC2C and uCTX-II in P group were observed in comparison to those in NP group. The sC2C / sPIICP ratio of P group (0.26) was significantly decreased in comparison to those of NP group (0.33, $p<0.01$). However, no significant difference of the uCTX-II / sPIICP ratio was observed between the P group and the NP group. When the subjects were divided into three groups according to the sC2C / sPIICP ratio at baseline (T1, T2 and T3), the age- and BMI- adjusted risk for the progression after 3-years of follow up in the lower tertile (T1) was significantly higher than that in the higher tertile (T3) [Odds ratio: 9.8 (95% CI: 1.4 to 67.4)].

CONCLUSION: It is suggested that OA develops from an imbalance in the synthesis and degradation of type II collagen, and that the ratio of the degradation to the synthesis biomarkers of type II collagen predicts more precisely the progression of OA than the individual biomarkers. In a three year prospective study of men in early forties without knee pain, the lower sC2C / sPIICP ratio was the risk factor for the radiographic progression of the medial knee joint width in men in early forties without knee pain.

P-5-8 AMPK-mediated regulation of protein degradation systems in unloaded mouse skeletal muscle

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INTRODUCTION: Skeletal muscle has a crucial role in metabolism as well as locomotion, but the molecular mechanism of muscle mass maintenance is yet completely understood and remains to be elucidated. 5'AMP-activated protein kinase (AMPK) is well-known as a metabolic sensor that helps maintain cellular energy homeostasis by modulating glucose, lipid, and protein metabolisms. Recently, it has been reported that AMPK controls skeletal muscle mass change under hypertrophic condition. However, it is unclear the evidence of AMPK in the maintenance of skeletal muscle mass during atrophic condition. Therefore, the aim of the present study was to investigate the involvement of AMPK in regulating skeletal muscle atrophy during hindlimb unloading.

METHODS: Transgenic (AMPK-DN) mice expressing a dominant negative mutant of AMPKα1 in the skeletal muscle and their wild-type littermates (WT) mice were randomly divided into two groups: untreated preexperimental control (n=12/group) and unloading (n=12/group) groups. Mice of the unloading group were subjected to continuous hindlimb suspension for 2 weeks. After the procedure, soleus muscles were dissected and wet muscle weight, expression levels of proteins; ubiquitinated proteins, forkhead-box class O (FoxO) 3a Ser^{253}, microtubule-associated protein 1 light chain 3 (LC3), p62, and 72-kDa heat shock protein (HSP72), and mRNAs; muscle RING finger 1 (MuRF1), and atrogin-1/muscle atrophy F-box (MAFbx), were evaluated.

RESULTS: Soleus muscle weight relative to body weight in WT mice was decreased by 30% in response to hindlimb suspension, whereas by 20% in AMPK-DN mice. The expressions of ubiquitinated proteins and MuRF1 mRNA, markers of ubiquitin-proteasome system activation, were upregulated by hindlimb suspension in WT mice, but no changes were observed in AMPK-DN mice. The expression of phosphorylated FoxO3a was decreased by hindlimb suspension in WT mice, but not in AMPK-DN mice. HSP72 expression was higher in AMPK-DN mice compared to WT mice during the experiment, and reduced more in WT mice by hindlimb suspension than AMPK-DN mice. On the other hand, breakdown of p62, a marker of autophagy flux, was not observed by hindlimb suspension in both WT and AMPK-DN mice, although the expression of LC3II relative to LC3I, a marker of autophagosome formation, was increased in response to hindlimb suspension by 8.0-fold and 2.0-fold in WT mice and AMPK-DN mice, respectively.

CONCLUSION: The present study demonstrated that the repression of skeletal muscle AMPK activation suppressed the progress of unloading-induced skeletal muscle atrophy. Furthermore, the activation of protein degradation system, especially ubiquitin-proteasome system, during unloading were disturbed under the repression of AMPK. These alterations might be attributed by the suppression of FoxO signaling and/or the upregulation of HSP72, as observed in AMPK-DN mice. Our findings suggest that AMPK is involved in adaptation of skeletal muscle mass to atrophic stimuli.

P-5-9 Role of pathogen sensor on inactivity-induced muscle atrophy

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BACKGROUND: Cast immobilization can result in skeletal muscle atrophy. Excessive inflammatory response is now considered to be a crucial mechanism for muscle atrophy in cast immobilization. However, the mechanism of muscle atrophy via inflammation induced by immobilization remain incompletely understood. Toll-like receptors (TLR) 4, which are a family of innate cellular pathogen-recognition receptors, have been shown to play critical roles in activation of inflammation. A recent study proposed that TLR4 plays a pathogenic role in muscle atrophy, because TLR4-knockout mice showed both lower sepsis-induced muscle atrophy and ubiquitin ligases activation than wild-type mice. Interestingly, recent study was shown that short-term bed rest induced increased TLR4 expression in the skeletal muscle of healthy older adults. Therefore, increased of TLR4 expression may be an important factor for muscle atrophy and excessive inflammatory response associated with inactivity. We have examined the role of TLR4 in cast immobilization-induced skeletal muscle atrophy using TLR4-defective C3H/HeJ mice.

METHODS: C3H/HeN mice and C3H/HeJ mice were divided into control and cast-immobilization groups. Cast immobilization was imposed for 14 days. Muscle atrophy in the gastrocnemius muscle was evaluated by analyzing the muscle mass and cross-sectional area of the muscle fiber. Gene expressions in the gastrocnemius were evaluated by real time-Reverse Transcriptase –Polymerase Chain Reaction.

RESULTS: Cast immobilization resulted in an increase in TLR4 mRNA expression in the gastrocnemius, and in a decrease in muscle mass of C3H/HeN mice. However, no difference in a decrease in gastrocnemius muscle mass, or in the gastrocnemius fiber cross-sectional area at day 14, in the cast immobilized group. Cast immobilization-induced increase in ubiquitin ligase mRNA was not affected by defective TLR4. In control groups, TNF-α mRNA expression in C3H/HeJ mice was lower than that in C3H/HeN mice. However, this variable did not differ between the cast-immobilized groups of the two mouse models at day 14.

CONCLUSION: Our findings in C3H/HeJ mice suggest that TLR4 may not play an essential role in immobilization-induced muscle atrophy.

P-5-10 Aging skeletal muscle is associated with increased adipognesis and impaired inflammation

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Sarcopenia is the age-related loss of skeletal muscle mass and strength leading to physical frailty, loss of independent daily living, increased lifestyle-related disease, and high health care costs. One concern is that the incidence of sarcopenia is increasing in the world. There is a great deal of interest in strategies to prevent or reverse sarcopenia in our aging population.

Aging muscle consists of fewer myofibers compared to adult muscle and these myofibers show signs of atrophy and increased muscle adiposity. Adiposity in skeletal muscle has been widely recognized as one of the hallmarks of sarcopenia. Adult skeletal muscle has a remarkable regenerative capacity, largely mediated by myogenic stem cells, termed satellite cells (SCs). SCs are located in the plasma membrane of myofibers beneath the basement membrane and are mitotically quiescent in adult muscle. During muscle regeneration, satellite cells are activated, giving rise to myoblasts that proliferate, differentiate and fuse together or fuse to pre-existing muscle fibers to produce fully mature muscle fibers. However, skeletal muscle regeneration is markedly impaired with age. Recently we demonstrated that the number of activated, proliferated, and differentiated SCs was lower in old rats compared with young rats after muscle damage. In addition, old rats exhibited impaired muscle regeneration and increased intermuscular adipocytes post-injury. Our data suggest that impaired regeneration of old skeletal muscle might be attributed to changes in several functions of SCs. We indicated that rat SCs are multipotent cells that can undergo not only myogenic, but also adipogenic differentiation *in vitro* and *in vivo*, and their adipogenic responses increase as a function of age.

Inflammation is an obligatory event in skeletal muscle injury. Recovery of skeletal muscle injuries requires severely injured myofibers to be degraded, phagocytized, and replaced via the migration and maturation of SCs. It is well established that macrophages are the dominant inflammatory cell type during early muscle injury and may contribute to skeletal muscle regeneration by facilitating myofiber repair via the production of inflammatory cytokines, chemokines, and growth factors. Recently we demonstrated that the number of activated macrophages within skeletal muscle was lower in old rats compared with young rats after muscle damage. In addition, our DNA chip data has indicated that the expression of genes including inflammatory cytokines, chemokines, and growth factors was attenuated during the regeneration of aged skeletal muscle. These data suggest that the impaired inflammatory response to muscle damage that occurs with aging may contribute to the impaired muscle regenerative capacity and to increased muscle adiposity, both characteristic of aged muscle. These factors may be underlying causes of sarcopenia.

P-5-11 Effects of treadmill running on bone density and strength in young mice

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BACKGROUND: It is well known that exercise has positive effects on bone. Especially, exercise in growing period increase bone formation. It has been found that treadmill running or jump exercise can affect bone turn over and bone morphology. However, effects of exercise in growing period on bone strength are little known.

PURPOSE: To investigate the effects of treadmill running exercise on bone density by μCT and bone maximal breaking force in young mice.

METHODS: 4 week-old male C57BL/6 mice (n=10) were assigned to two groups; 1) sedentary group (CON, n=5) as a control, or 2) treadmill running exercise group (TRE, n=5). Mice in treadmill running exercise group were forced to running on treadmill, 6-18m/min, 30min/day, 5days/week, for 16weeks. Mice were sacrificed at 20 weeks of age and removed the right and left lower limb, skeletal muscles (soleus, gastrocnemius, plantaris, anterior tibialis, extensor digitorum longus, quadriceps), white adipose tissue. The right limb was measured bone density (mg/cm^3) using μCT. The left femur was measured maximal breaking force (N) using three-point bending test. All data shows average ± standard deviation.

RESULTS: Body weight in CON and TRE groups was CON: 24.3±0.9g, TRE: 24.2±1.1g, respectively. White adipose tissue weight was CON: 284.7±22.9 g and TRE: 331.5±84.4g, respectively. Muscle weight was CON: 403.5±22.0g, TRE: 386.1±12.8g, respectively. There were no significant differences in these parameters between CON and TRE groups. Also for bone parameters, cortical bone density in treadmill running exercise group was higher than control group, significantly (CON: 884.1±19.7 mg/cm^3 and TRE: 904.9±4.9 mg/cm^3). While, there was no significant difference in cancellous bone density between CON and TRE groups (CON: 327.5±18.2 mg/cm^3 and TRE: 331.6±12.3 mg/cm^3). Total bone density in exercise group was higher than control group, significantly(CON: 576.3±12.6 mg/cm^3 and TRE: 594.9±8.0 mg/cm^3, $p<0.05$). Maximal breaking force of femur was respectively; CON: 11.1±1.3 N and TRE: 11.0±0.4 N. There was no significant difference in maximal breaking force between CON and TRE groups.

CONCLUSION: Our data suggests that treadmill running exercise for 16 weeks did not alter bone maximal breaking force, but can increase bone density in young mice.

P-5-12 In vivo calcium regulation in diabetic skeletal muscle: fiber-type specific effects

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INTRODUCTION: Type 1 diabetes impairs Ca^{2+} handling in many tissues such as cardiac muscle, platelets, kidney and liver. In skeletal muscle, the diabetic state increases resting intracellular Ca^{2+} ($[Ca^{2+}]_i$) levels and induces activity of Ca^{2+}-dependent proteolytic pathways. In skeletal muscle, dysfunctional contractile activity has been linked to impaired $[Ca^{2+}]_i$ regulation. Muscle force production is impaired and fatigability and muscle fragility deteriorate with diabetes. Recently, we succeeded in measuring in vivo $[Ca^{2+}]_i$ within the mixed fiber-type rat spinotrapezius muscle (1) following contractions. In this preparation, intramyocyte injection of a high $[Ca^{2+}]$ bolus revealed a depressed Ca^{2+} buffering capability in diabetes which corresponded with the elevated post-contraction $[Ca^{2+}]_i$ (2). Unfortunately, that preparation did not permit resolution of between fiber type effects on the profile of $[Ca^{2+}]_i$ following contraction in Type 1 diabetes which remain to be resolved. We tested the hypotheses that: 1. The rise in resting $[Ca^{2+}]_i$ evident in diabetic rat slow-twitch muscle would be exacerbated in fast-twitch muscle following contraction. 2. These elevated $[Ca^{2+}]_i$ levels would relate to derangement of microvascular O_2 pressures ($PmvO_2$) rather than sarcoplasmic reticulum (SR) dysfunction per se.

METHODS: Adult male Wistar rats were divided randomly into diabetic (DIA: Streptozotocin i.p.) and healthy (CONT) groups. Four weeks later extensor digitorum longus (EDL, predominately type II fibers) and soleus (SOL, predominately type I fibers) muscle contractions were elicited by continuous electrical stimulation (120 s, 100 Hz). Ca^{2+} imaging was achieved using Fura-2 AM in vivo. Phosphorescence quenching techniques were used to measure $PmvO_2$.

RESULTS: DIA increased fatigability in EDL ($P<0.05$) but not SOL. In recovery, SOL $[Ca^{2+}]_i$ either returned to its resting baseline within 150 s (CONT, 1.00 ± 0.02 at 600 s) or was not elevated in recovery at all (DIA, 1.03 ± 0.02 at 600 s, $P>0.05$). In recovery, EDL CONT $[Ca^{2+}]_i$ also decreased to values not different from baseline (1.06 ± 0.01, $P>0.05$) at 600 s. In marked contrast, EDL DIA $[Ca^{2+}]_i$ remained elevated for the entire recovery period (i.e., 1.23 ± 0.03 at 600 s, $P<0.05$). The inability of $[Ca^{2+}]_i$ 40 to return to baseline in EDL DIA was not associated with any reduction of SERCA1 or SERCA2 protein levels (both increased 30-40%, $P<0.05$). However, PmvO2 recovery kinetics were markedly slowed in EDL such that mean PmvO2 was substantially depressed (CONT, 27.9 ± 2.0 vs DIA, 18.4 ± 2.0 mmHg, $P<0.05$) and this behavior was associated with the elevated $[Ca^{2+}]_i$. In contrast, this was not the case for SOL ($P>0.05$) in that neither $[Ca^{2+}]_i$ nor $PmvO_2$ were deranged in recovery with DIA.

CONCLUSION: In conclusion, compromised Ca^{2+} buffering and elevated $[Ca^{2+}]_i$ following an in vivo fatiguing tetanic contraction occur preferentially in the fast twitch EDL rather than the slow twitch SOL muscle. This process is associated with a substantial reduction in microvascular oxygen pressure that may be responsible, in part, for the dysfunctional Ca^{2+} buffering and greater fatigue. If dysfunction of SERCA1 and SERCA2 does occur it is possible that this relates to oxygen levels ($PmvO_2$) as their protein levels are up- and not down-regulated in EDL. Because the EDL muscle fibers undergo significant diabetes-induced atrophy it is also feasible that the mitochondrial reticulum undergoes damage and its capacity to buffer $[Ca^{2+}]_i$ is degraded. That eventuality remains to be experimentally tested (3).

1) Sonobe et al. Am J Physiol Regul Integr Comp Physiol. 2008.
2) Eshima et al. Am J Physiol Regul Integr Comp Physiol. 2013.
3) Eshima et al. Am J Physiol Regul Integr Comp Physiol. 2015.

P-5-13 Metabolome and peptidome analyses of autophagic degradation

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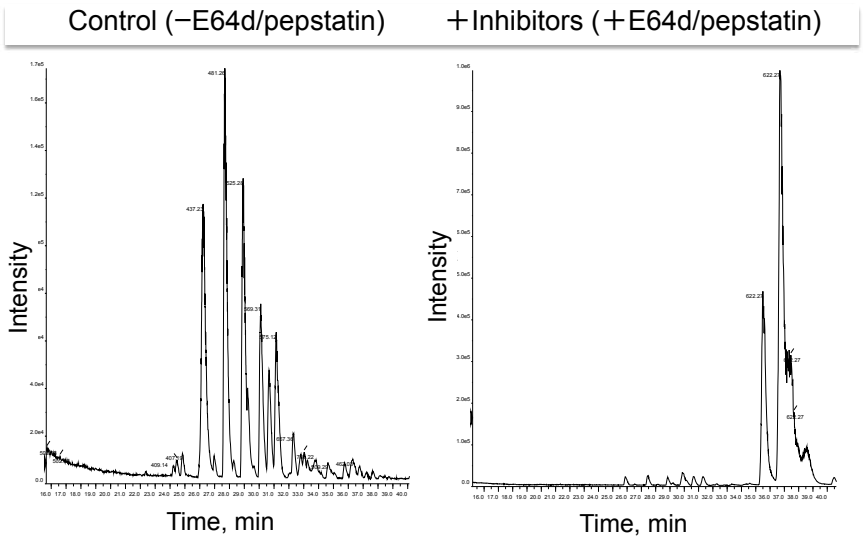
Autophagy is a large-scale degradative system, by which cellular constituents, including cell organelles and cytosolic proteins, are broken down via the lysosomes. Autophagy initiates with the formation of smooth limiting membrane, which extends and sequesters surrounding cytoplasm to form a double-membraned autophagosome. Autophagosome then fuses with the lysosome to mature into autolysosome. It was thought previously that sequestered cytoplasmic components in the lumen were degraded completely by lysosomal hydrolases to their elements, such as amino acids, fatty acids, sugars, etc. However, it has been shown recently that some degradation intermediates or products are discharged to the extracellular milieu. As these compounds derive from the relevant tissues or cells, characterization of these excreted compounds may be beneficial to understand cell type- or tissue type-specific autophagic process.

Using mass spectrometry, we extensively analyzed peptides and low-molecular compounds released from HeLa cells and mouse embryonic fibroblasts (MEF) when they were incubated with Krebs bicarbonate buffer (KRB)(nutrient deprivation conditions). We found that in addition to amino acids significantly more peptides were released from the control cells than those from the cells treated with E64d plus pepstatin A (lysosomal proteinase inhibitors). Identification of these discharged peptides will be reported.



P-5-14 Seasonal changes in physical fitness of adolescent track and field athletes

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INTRODUCTION: In track and field event, a year divided roughly into three season such as training period in winter, preparing period to competition in spring, and competition period in summer and autumn. In general, training of purpose and program are different in each period. Physical fitness of adolescent athletes would be reduce, as a results of the decrease in the amount or frequency of strength training. It is not known how seasonal changes in physical fitness affect the performance, namely time in sprint running. The purpose of this study was to identify seasonal changes in physical fitness of adolescent track and field athletes.

METHODS: Participants were 11 males (16.4±0.6 years, 171.9±5.1cm, 60.8±5.2kg; at the first test) and 7 females (16.8±0.5 years, 160.7±3.6cm, 51.5±4.1kg; at the first test) from 2 track and field clubs in these high school. The schedule of tests was performed 3 times a year; training period in end of November to December, preparing period in March, and competition period in August. We applied physical fitness parameters: sprint running performance, jumping performance, single-joint isometric torque, and anthropometric characteristics. Sprint running performance was measured duration time in 100m sprint running. Jumping performance was measured jump height of 5 kinds of jump (squat jump; SQJ, counter movement jump; CMJ, and drop jump from height of 30-50cm; DJ30, DJ40, DJ50), and the highest score of two trials were adopted their jump scores. Single-joint isometric torque of knee extension (KE TQ), knee flexion (KF TQ), dorsiflexion (DF TQ), and plantar flexion (PF TQ) at right side were measured with an isometric dynamometer. The maximum values of measured twice at each trial were accepted as the TQ score, and which evaluated rate of body weight. Assessments of anthropometric characteristics were height, body weight, subcutaneous fat thickness, and muscle thickness. Measurements of subcutaneous fat thickness and muscle thickness at right side were used B-mode ultrasonic apparatus, in accordance with Fukunaga et al. (1989). The percent of body fat and fat-free mass were estimated from equation by Abe et al. (1994). Seasonal changes were assessed using Friedman test and post hoc Wilcoxon test to each sex.

RESULTS: There were significant differences among periods to all physical fitness parameters in male athletes. Sprint running performance at competition period was faster than other periods. Similarly, DJ50, KF TQ, and DF TQ at competition period was higher than other periods. In anthropometric characteristics, body weight at preparing period was higher than other periods. And fat-free mass at competition period was higher than training period. Female athletes were found that only CMJ and body weight were significant differences among periods.

DISCUSSION: Physical fitness were found seasonal changes in adolescent track and field athletes of each sex. Although, it tend to different in each sex. In male athletes, sprint running performance was improved at competition period. In addition, DJ50, KF TQ, and DF TQ were also increased, and which parameters were indicated to relationship with sprint running performance in previous study (Young et al. 1995, .Tonson et al. 2007). On the other hand, seasonal changes of female athletes were only limited physical fitness parameters. It had little difference of training program in males and females. It was not have the results that explain the sex difference for seasonal changes.

Conclusion: This study was suggested that training in competition period can be enhance essential physical fitness to the competition for a track and field event in especially male athletes.

P-5-15 The sprinting ability involved change of direction on the decision making in female soccer players

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BACKGROUND: Change of direction (COD) is an important physical quality for soccer players. Previous studies have suggested that agility contains both a COD movement and a perceptual and decision making component (Young et al.,2002 ; Sheppard et al.,2006). However, there is a lack of evidence regarding the sprinting ability involved COD on the decision making in female soccer players. The purpose of this study was to investigate the sprinting ability involved COD on the decision making in female soccer players and compare to different sports (soccer vs. track-and-field athletes) or competitive levels (regular vs. non-regular).

METHODS: Thirty-three university female athletes participated in this study, and divided into 4 groups (n=24: soccer (n=11: regular, n=11: non-regular) n=9: track-and-field athletes). To determine the sprinting ability with straight ahead and COD on the decision making, 20 m sprint test and 20 m sprint cutting to 90° at 10 m point (CUT90) arranged in the point to make a decision about whether to right or left turn according to light stimulation at 2.5, 5 and 7.5 m were conducted using electric timing gates (smart-speed). In addition, to assess the COD, CUT90 (right and left turn) were also performed.

RESULTS: The 20 m sprint time of track-and-field athletes were significant faster than that of soccer players ($p<0.05$). The other measurement variables did not differ significantly between soccer players and track-and-field athletes. In the female soccer groups, the 20 m sprint time did not differ significantly between regulars and non-regulars. However, all sprint times of COD on the decision making in the regulars were significantly faster than non-regulars ($p<0.05$). Moreover, superior ($p<0.05$) and inferior ($p<0.01$) CUT90 (right and left turn) in the regulars were significantly faster than non-regulars. In the non-regulars, CUT90 were significantly between superior and inferior. But the regulars, did not differ significantly.

CONCLUSION: This study suggested that the COD ability with or without decision making was not correlated to the 20 m sprinting performance in a straight line. Moreover, in female soccer players, the COD ability of regular players was shown to be a small difference between superior and inferior turn of CUT90 without decision making.

P-5-16 Effects of different visual class on agility in the visually impaired soccer players

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BACKGROUND: Agility has classically been defined as simply the ability to change direction rapidly, more recent agility to include whole-body change of direction as well as rapid movement and direction change of limbs. The agility is regarded as one of the important end-point in evaluating soccer players. The class of the visual impairment is distributed between three phases B1 (blind to light sense), B2 (eyesight 0.03 to field of vision 5 degrees) and B3 (eyesight 0.1 to field of vision 20 degrees). It is reported that the agility of the visually impaired is lower than sighted person. However, there is not the report about the ability of the agility for visually impaired soccer players. The purpose of this study was to obtain the reference values, which agility of the visually impaired soccer players.

METHODS: Visually impaired soccer players (B1: n=12, B2: n=4, B3: n=5) and university soccer players (n=12) participated in the study. B2 and B3 play a game as "low vision soccer" together at the statistics it was with the same group. The evaluation of the ability for agility was used side step test. It was considered in safety and the movement style on the occasion of a practice, and 2 kinds of help rope (1 fulcrum help rope: The pendulum type and 3 fulcrums help rope: Weight mobility) was used. Every time a subject passed a line on the occasion of help of a practice was used, the equipment which issues a feeble sound stimulus.

RESULTS: For B1 players, the number of side steps was 54 ± 7 times and 44 ± 6 times in both of 1 fulcrum help rope and 3 fulcrums help rope. For B2•B3 players, the number of side steps was 56±3 times and 51±3 times in both of 1 fulcrum help rope and 3 fulcrums help rope. For University soccer players, the number of side steps was 49±4 times and 65±6 times in both of 1 fulcrum help rope and 3 fulcrums help rope, respectively. B2•B3 players had significant higher number of side steps than B1 group and university soccer players in 3 fulcrums help rope ($P<0.01$). Moreover, university soccer players had significant higher number of side steps than B1 group and B2•B3 players in 1 fulcrums help rope ($P<0.01$).

CONCLUSION: In this study achieved results such as obtain the reference values that agility of the visually impaired soccer players, and clarify the difference in the agility ability of the weight mobilityin the test using the 3 fulcrums help rope.

P-5-17 Impact of muscular evaluation by 3D-CT

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INTRODUCTION: Characteristics of muscular morphology is assumed to be one of the determining factors for its mechanical function and a particularly important evaluation index in the field of sports. Muscle evaluation is generally performed using ultrasound and MRI with major endpoints of thickness and cross sectional area. However, due to its complicated anatomy, a skeletal muscle presents different area depending on its cross section site. Therefore, muscle volume should be used as an index to evaluate the whole muscle. The narrow observable field of view in ultrasound and the long imaging time of an MRI make these methods unsuitable for the evaluation of muscle volume. In contrast, CT allows for short measurement time and clear image over a wide area. It can also selectively extract data from each cross sectional data to build a three-dimensional image (3D-CT) of the target muscle with accurate measurement of the muscle volume. This study was aimed to examine the efficiency and usefulness of the whole muscle extraction by 3D-CT and the measurement of muscle volume.

METHODS: Cross sectional images of the thigh at slice thickness 1mm using multi-slice CT were obtained from male athletes specializing in track and field. Quadriceps femoris (QF) and hamstrings (Ham) were selected as target muscles and selectively extracted 10 times using an image analysis work station made by AZE company. We evaluated the whole form, origin, termination and muscle volume of each muscle. As quantitative detail, we calculated the mean, standard deviation, and coefficient of variation (CV) of the volume.

RESULTS AND DISCUSSION: The mean muscle volume were 2341.3±14.78cm^3 for QF and 1128.3±18.04cm^3 for Ham. CV of QF and Ham were less than 1% and less than 2%, respectively. CT is known to be superior in spatial resolution. Both quadriceps femoris and hamstrings have multiple origins and terminations, all of which were clearly observed in this study. Accurate muscular morphological evaluation is extremely important in elucidating characteristics of the muscular force exertion. This study suggested that 3D-CT is a useful method for evaluating the anatomical basis of the human body in detail. We will further clarify its utility by comparing other muscle volume calculation methods in the future.

Volume(cm^3)		QF	Ham
Trials	1	2300	1131
	2	2341	1105
	3	2343	1159
	4	2343	1112
	5	2348	1117
	6	2344	1150
	7	2354	1114
	8	2357	1117
	9	2344	1126
	10	2339	1152
Mean		2341.3	1128.3
SD		14.78	18.04
CV		0.006	0.016

Table 1.
The volume, mean value, SD and CV in 10 Trials of QF and Ham

P-6-1 Contribution of mitochondrial superoxide and SOD2 imbalance to the locomotive syndrome

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Age-related motor organ failure is the major problem in super-aged society because it is leading to care requirements or bedridden. Although locomotive syndrome is recently defined as the individual state with gait disturbance having functional decline of motor organs; bone, cartilage, intervertebral disc, nerve and skeletal muscle, it has been practically difficult to treat it because the cause is complicatedly multifactorial, such as osteoporosis, osteoarthritis, sarcopenia and so on. Superoxide dismutase 2 (SOD2) is the endogenous mitochondrial antioxidant enzyme which converts superoxide anion to hydrogen peroxide to maintain the reduction-oxidation balance in cells. The physiological role of SOD2 and the pathological role of superoxide in degeneration of motor organs have been investigated in our previous study using tissue-specific SOD2-deficient mice. Here we focused on the effect of mitochondrial superoxide and SOD2 imbalance in the development of the locomotive syndrome.

We generated conditional SOD2-deficient mice crossbreeding *Sod2 flox* mice with dentin matrix acidic phosphoprotein (DMP1) promotor Cre, type2 collagen (Col2) promotor Cre and human skeletal actin (HSA) promotor Cre mice to find tissue-specific phenotypes in osteocyte, chondrocyte and skeletal muscle, respectively. Osteocyte-specific SOD2 deficiency showed both increased expression of sclerostin leading to suppressed bone formation and increased expression of receptor activator of NF-kB ligand (RANKL) causing activated bone resorption. As a result, the mutant mice *in vivo* showed remarkable bone loss in an age-dependent manner, composing increase of disorganized osteocytic canalicular networks and decrease of live osteocytes number. Chondrocyte-specific deletion of SOD2 promoted mitochondrial superoxide overproduction, mitochondrial dysfunction and impaired extracellular matrix homeostasis, leading to spontaneously accelerated cartilage degeneration both during aging and under mechanical loading. Furthermore skeletal muscle-specific SOD2-deficient mice displayed increased selective loss of enzymatic activity in mitochondrial respiratory chain complexes and reduced ATP content in their muscle, leading to severe disturbances in exercise activity.

These findings demonstrate that mitochondrial superoxide in common plays a pivotal role in the development and progression of osteoporosis, osteoarthritis and muscle weakness, so to speak, age-related locomotive dysfunction, and suggest that the regulation of superoxide balance in the local tissue or in the entire body is a promising target for the treatment of locomotive syndrome.

P-6-2 The effect of the combination of increased physical activity with walking with blood flow restriction on leg muscle thickness and walking performance in older adults

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The purpose of this study was to investigate the effect of the combination of increased physical activity with walking with blood flow restriction in working muscles (BFR) on leg muscle thickness and walking performance in older adults.

Twenty-six older subjects (age 69±1 years, height 1.63±0.02 m, body weight 64.5±2.0 kg) were divided into the three following groups: normal physical activity (NPA, n=14, 12 men and 2 women), walking with BFR of once a week (BFR1, n=9, 6 men and 3 women) and walking with BFR of twice a week (BFR2, n=3, 1 man and 2 women). All groups were instructed to walk at a self-selected, faster pace than usual for more than 30 min per session, and climb more than 5 flights of stairs per day, more than four days per week, respectively. Additionally, BFR1 and BFR2 groups performed 20 minutes of treadmill walking with BFR at a pre-determined exercise intensity of 70-85% of age-predicted maximum heart rate (HRmax: 220 - age). In both BFR groups, nylon cuffs were applied tightly at the most proximal portion of both legs during a training session. The pressure value was calculated for each subject based on the circumference of the right thigh (33 % of the distance from the inguinal crease to the top of the patella) based on the previous study as follows: <50 cm = 100 mmHg; 51-55 cm = 120 mmHg; 56-59 cm = 140 mmHg; >60 cm =160 mmHg. Muscle thickness (MT) was measured via B-mode ultrasound using a 5-18 MHz scanning head (Noblus; Aloka, Tokyo, Japan) at the four following sites: knee extensors (KE) and flexors (KF) at 50% of thigh length and dorsi flexors (DF) and plantar flexors (PF) at 30% of lower leg length before and after a 3-month training program. Walking performance was measured using a 10-m walkway. All results are expressed as means with standard errors. Effect sizes (ESs) were calculated as [(Post Mean – Pre Mean)/ Pre Standard Deviation]. ESs < 0.20 were considered trivial, 0.20-0.49 small, 0.50-0.79 moderate, and > 0.80 large.

Two-way repeated measures ANOVA showed that the time effects were significant ($p<0.01$) for MTs of KF (NPA: pre 54.7±1.8 mm, post 56.9±1.5 mm, BFR1: pre 54.2±2.6 mm, post 55.4±0.6 mm, BFR2: pre 52.1±1.3 mm, post 55.4±2.4 mm) and PF (NPA: pre 63.0±1.4 mm, post 64.3±1.4 mm, BFR1: pre 61.2±1.4 mm, post 62.1±1.4 mm, BFR2: pre 57.7±3.5 mm, post 61.5±2.5 mm). The ESs of KF and PF were as follows: 0.34 and 0.26 for NPA, 0.16 and 0.22 for BFR1 and 1.52 and 0.62 for BFR2. The ESs for NPA and BFR1 ranged from trivial to small, whereas for BFR2 ranged from moderate to large. Meanwhile, the MTs of KE (NPA: pre 32.7±1.6 mm, post 30.9±1.4 mm, BFR1: pre 32.6±2.2 mm, post 29.3±1.5 mm, BFR2: pre 27.1±1.2 mm, post 28.6±0.3 mm) and DF (NPA: pre 26.5±0.8 mm, post 26.2±0.9 mm, BFR1: pre 24.0±1.0 mm, post 25.0±0.8 mm, BFR2: pre 23.8±1.8 mm, post 24.2±1.8 mm) were did not change. The ESs of KE and DF were as follows: -0.30 and -0.09 for NPA, -0.50 and 0.35 for BFR1 and 0.69 and 0.14 for BFR2. 10-m walking time was significantly improved in all groups after a 3-month training period (NPA: pre 5.27±0.24 sec, post 5.19±0.24 sec, BFR1: pre 5.02±0.19 sec, post 4.71±0.17 sec, BFR2: pre 5.31±0.18 sec, post 4.84±0.26 sec). The ESs were -0.09 for NPA, -0.53 for BFR1 and -1.54 for BFR2, respectively.

The combination of increased physical activity with walking with BFR can improve the MTs of KF and PF and walking performance in older adults.

P-6-3 The effects of exercise training combined increase physical activity with walking with blood flow restriction on locomotive syndrome risk test parameters in the elderly adults

NAKAGATA Takashi, OZAKI Hayao, MACHIDA Shuichi, ISHIBASHI Masayoshi, NAITO Hisashi
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The purpose of this study was to examine the effect of blood flow restriction walking training for 6 months on locomotive syndrome in the elderly adults.

A total of twenty-three participants aged 68.3 ± 5.4 (61-82) year-old, 18 men and 5 women, took part in the study. This study consisted of two groups, control-walk training group (CON-W, n = 15) and blood flow restriction walk training group (BFR-W, n = 8). CON-W group performed more than 30 min walking training at a self-selected, faster than usual, at least three days for a week. Additionally, BFR-W group performed a 20 minutes treadmill walking once a week at an exercise intensity of 70-85 % of age-predicted maximal heart rate (HRmax = 220 – age). The BFR-W group wore pressure cuffs on both legs during training. We measured Locomotive syndrome risk test (The stand-up test, The two-step test, 25-question risk assessment) by The Japanese Orthopedic Association. The two-step score was calculated as follow, length of both strides in cm ÷ height in cm. The locomotive syndrome risk test is designed to evaluate present level of mobility. All participants continued training program for six months. Two-way repeated measures analysis of variance (ANOVA) was used to study the main effects of group (CONT-W or BFR-W), time (0 month, 3month, 6 month) on the dependent variables of all measurements. P-values of equal to or less than 0.05 were considered statistically significant for all analyses.

Significant condition effect was observed in two-step test (p = 0.026), with no interaction group × time (1.45 ± 0.13, 1.46 ± 0.17, 1.49 ± 0.13, 0 month, 3month, 6 month). But, present study did not find the main effect of group, time and interactions between group × time in the stand-up test, 25-question risk assessment.

The combination of increased physical activity with walking with BFR can improve the two-step test.

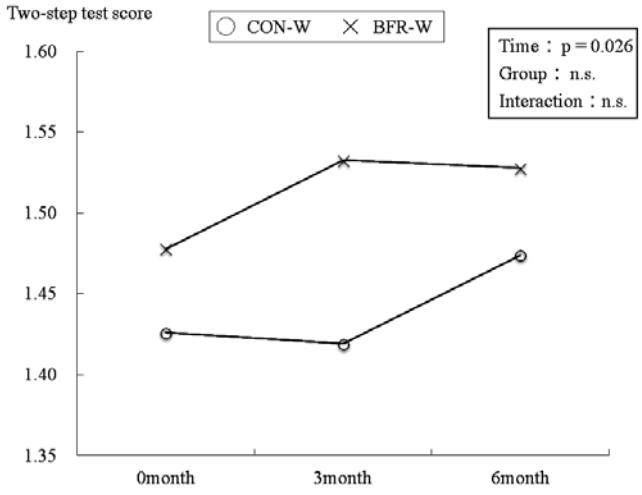


Fig 1. Two-step test score o month, 3 month and 6 month.

P-6-4 Effect of exercise intervention on locomotive syndrome in Japanese elderly

KITADA Tomoharu, OZAKI Hayao, NAKAGATA Takashi, ISHIBASHI Masayoshi, MACHIDA Shuichi, NAITO Hisashi
Graduate School of Health and Sports Science, Juntendo University

PURPOSE: The purpose of this study was to investigate the effect of exercise intervention on locomotive syndrome in Japanese elderly.

METHODS: Twenty-one older subjects (age 69±6 years, height 1.63±0.83 m, body weight 64.5±10.4 kg) were divided into the two following groups: normal physical activity (NPA, n=12, 10 men and 2 women), walking with blood flow restriction (BFR) of once a week (BFR1, n=9, 6 men and 3 women). The both groups were weared acceleration sensor (Life Microscope; Hitachi, Tokyo, Japan) at the wrist and were instructed to walk at a self-selected, faster pace than usual for more than 30 min per session, and climb more than 5 flights of stairs per day, more than four days per week, respectively. Each physical activity levels (Ex1; 1.0 < 1.1 Mets, Ex2; 1.1 < 1.5 Mets, Ex3; 1.5 < 3.0 Mets, Ex4; 3.0 < 6.0 Mets , Ex5; 6 < Mets) were measured by Life Microscope during exercise intervention. Additionally, BFR group performed 20 minutes of treadmill walking with BFR at a pre-determined exercise intensity of 70-85% of age-predicted maximum heart rate (HRmax: 220 - age). In the BFR groups, nylon cuffs were applied tightly at the most proximal portion of both legs during a training session. The suitable pressure value was calculated for each subject based on the circumference of the right thigh (33 % of the distance from the inguinal crease to the top of the patella), as follows: <50 cm = 100 mmHg; 51-55 cm = 120 mmHg; 56-59 cm = 140 mmHg; >60 cm =160 mmHg. Muscle thickness (MT) was measured via B-mode ultrasound using a 5-18 MHz scanning head (Noblus; Aloka, Tokyo, Japan) at the following four sites: knee extensors (KE) and flexors (KF) of thigh length and dorsi flexors (DF) and plantar flexors (PF) of lower leg before and after a 3-month training program.

RESULTS: After exercise intervention, steps (7150±3841 to 8335±4414 steps, $p < 0.01$) in all subjects were significantly increased, respectively. The change in Ex5 with exercise intervention was positively correlated with MT at 40% of PF ($r = 0.522$, $p < 0.05$) and locomotive syndrome risk test ($r = 0.457$, $p < 0.05$).

CONCLUSIONS: A increase in high physical activity (6 Mets <) by exercise intervention improves muscle volume and locomotive syndrome.

P-6-5 Relationship between locomotive syndrome risk test parameters and physical activities in elderly people

ISHIHARA Yoshihiko, OZAKI Hayao, NAKAGATA Takashi, ISHIBASHI Masayoshi, MACHIDA Shuichi, NAITO Hisashi
Faculty of Health and Sports Science, Juntendo University

This study was aimed to investigate the relationship between locomotive syndrome risk test parameters and physical activities in elderly people.

Thirty-nine elderly subjects (age 68.7 ± 5.5 years, 25 males and 14 females) were participated in this study. All subjects were completed the stand-up test, two-step test and 25-question geriatric locomotive function scale (25-question GLFS). Height, weight, waist circumference (WC), % body fat and muscle mass were measured. Body mass index (BMI) and waist-to-hip ratio were calculated. Daily physical activity was evaluated by three-axis high frequency wrist worn accelerometer for a week. Accelerometers calculated daily step counts and classify activity time into five intensities (ex1: resting, ex2: sitting, ex3: standing, ex4: moderate, ex5: vigorous).

Subject characteristics were height 1.62 ± 0.08 m, body weight 62.5 ± 9.2 kg, BMI 23.9 ± 3.2 kg/m^2, WC 87.2 ± 9.4 cm, waist-to-hip ratio 0.86 ± 0.05, body fat 26.6 ± 7.5 % and muscle mass 25.0 ± 4.2 kg. Total accelerometer steps were 6997 ± 3519 counts/day. Time spent in moderate-to-vigorous physical activity (MVPA: ex4 and 5) was 44.0 ± 30.0 min/day. The stand-up test and two-step test were correlated negatively with BMI, body fat and WC. However, those tests were not correlated with the PA parameters. 25-question GLFS was not correlated with body compositions and PA parameters. For males, two-step test was significantly correlated with the time spent in ex3, BMI and WC ($r = 0.44$; $p = 0.03$, $r = -0.51$; $p = 0.01$ and $r = -0.65$; $p = 0.00$), whereas stand-up test and 25-question GLFS were not correlated with the other PA parameters. For females, two-step test was correlated negatively with the weight, BMI, body fat and WC ($r = -0.54$; $p = 0.05$, $r = -0.70$; $p = 0.01$, $r = -0.66$; $p = 0.01$ and $r = -0.64$; $p = 0.01$). Stand-up test was also correlated negatively with WC ($r = -0.64$; $p = 0.01$), whereas the locomotive syndrome risk test parameters were not correlated with the PA parameters.

Our findings suggested that central obesity was associated with locomotive syndrome, and although daily physical activity was a little associated with locomotive syndrome in elderly man, these valuables were fundamentally associated with locomotive syndrome.

P-6-6 Assessment of a University-Based Exercise Program for Locomotive and Metabolic Syndrome in the elderly people

YOSHIHARA Toshinori[1)], **OZAKI Hayao**[2)], **NAKAGATA Takashi**[2)], **NATSUME Toshiharu**[1)], **MACHIDA Shuich**[1,2)], **NAITO Hisashi**[1,2)]
Institute of Health and Sports Science and Medicine, Juntendo University[1)]; School of Health and Sports Science, Juntendo University[2)]

PURPOSE: The purpose of this study was to examine the effects of university-based exercise program on metabolic parameters in elderly people. We hypothesized that limb blood flow restriction during walking is more effective to improve metabolic parameters of elderly people.

METHODS: A total of 23 older subjects (age 69 ± 1 years, height 1.63 ± 0.02 m, body weight 64.5 ± 2.0 kg) were assigned into either a limb blood flow restriction during walking group (n=12, BFR) or normal physical activity control group (n=14, CON). All groups was instructed to walk at a self-selected, faster pace than usual for more than 30 min per session, and climb more than 5 flights of stairs per day, more than four days per week, respectively. BFR group performed 20 min treadmill walking with limb blood flow restriction (100-160 mmHg) at a pre-determined exercise intensity of 70-85% of age-predicted maximum heart rate (HRmax: 220 - age), once or twice a week, for 6 months. The pressure value was calculated for each subject based on the circumference of the right thigh (33 % of the distance from the inguinal crease to the top of the patella), as follows: <50 cm = 100 mmHg; 51-55 cm = 120 mmHg; 56-59 cm = 140 mmHg; >60 cm =160 mmHg. This is because arterial occlusion pressure is largely influenced by thigh circumference. Before and after the exercise program, height, body weight (BW), waist circumference (WC), muscle mass, fat mass and body fat (%Fat). Body composition was determined by bioelectrical impedance analysis using a body composition analyzer (InBody720; Biospace). Moreover, metabolic parameters of blood were measured for fasting blood glucose, serum insulin, total cholesterol (Total-C), LDL-C, HDL-C, triglycerides, HbA1c. The data obtained over the 6 months period were analyzed by 2-way ANOVA (Condition × Time).

RESULTS: The results showed that after 6 months in the intervention, body weight, waist circumference (WC), body mass index, fat mass, %Fat and blood hemoglobin A1c (HbA1c) levels decreased significantly in CON and BFR groups ($p < 0.05$). In contrast, the muscle mass exhibited a significant increase in both condition ($p < 0.05$). There was no significant change in the HOMA-IR, triglyceride (TG), total cholesterol, high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) in both conditions ($p < 0.05$).

CONCLUSIONS: The results of the current study indicate that 6 months of university-based exercise program is effective to improve body composition and HbA1c level of older adults regardless of the training conditions.

P-6-7 An outpatient-based survey about the recognition of locomotive syndrome in Tokyo: a survey for 3 years

TANABE Yu[1], SUEHARA Yoshiyuki[1], Yongji KIM[1], ISHII Midori[1], KAWASAKI Takayuki[1], MATSUOKA Joe[2], AKAIKE Keisuke[1], MUKAIHARA Kenta[1], OKUBO Taketo[1], KUBOTA Daisuke[1], SAITO Tsuyoshi[3], TAKAGI Tatsuya[1], KANEKO Kazuo[1]

Department of Orthopedic Surgery, School of Medicine, Juntendo University[1]; Clinical Research Center and The Center for Lifetime Cancer Education, School of Medicine, Juntendo University[2]; Department of Human Pathology, School of Medicine, Juntendo University[3]

BACKGROUND: In 2007, the Japanese Orthopedic Association (JOA) proposed the term locomotive syndrome (LS) to designate a condition in high-risk groups of patients with musculoskeletal diseases who are highly likely to require nursing care. LS is caused by weakening of the musculoskeletal organs, such as the bones, joints and muscles. Disorders of these organs leads to self-transportation disabilities. These conditions force people suffering from this syndrome to require outside care and support. Therefore, to prevent the decline into disability, patients need to maintain their health, especially their locomotor function. To prevent locomotor dysfunction, the JOA has carried out numerous campaigns to increase the awareness of LS. However, there are no accurate studies regarding the recognition of LS. Therefore, we have started to survey the recognition of LS since 2013 to elucidate the effects and trends of the recognition of LS and the promotion campaigns using orthopedic outpatient cohost.

METHODS: To investigate the recognition of LS, we conducted a questionnaire survey including both the 25-question Geriatric Locomotive Function Scale (GLFS-25) and/or the “loco-check” in approximate 1000 orthopedic outpatients at Juntendo University Hospital (Tokyo, Japan) from March to June (for 3 months) since 2013 (for 3 years)

RESULTS: We have performed these surveys for 3 years (in 2013, 2014 and 2015). In first year, we surveyed the recognition of LS and found 24.6% of outpatients knew about LS in 2013. In 2014, a total of 26.4% of the patients knew about the concept of LS, which was increased 1.8% in comparison to our survey in 2013. With regard to the prevalence of LS in orthopedic outpatients, 60.5% (734 of 1,027 people who answered the questions) were classified into the LS high-risk group as determined using the GLFS-25. The prevalence of LS was 54.9% in males and 64.3% in females. We also resurveyed the recognition of LS and the prevalence of LS in 2015, and we are analyzing these acquired data in 2015 as on-going study.

CONCLUSION: We investigated the recognition of LS and the prevalence of LS using an outpatient cohort from the Tokyo area. This study demonstrated that the recognition of LS is a little bit increasing. Our outpatient-based survey is therefore considered to positively help obtain a better understanding of the effects and trends of promoting the concept of LS.

P-6-8 Acute changes in blood lactate concentration, muscle thickness and strength after walking with blood flow restriction in older adults

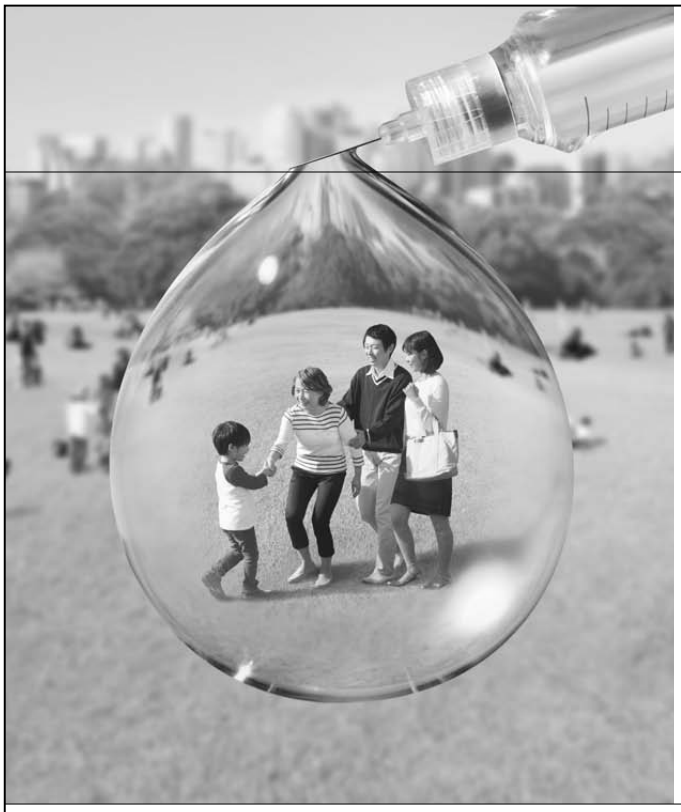
NATSUME Toshiharu, OZAKI Hayao, NAKAGATA Takashi, MACHIDA Shuichi, NAITO Hisashi
Graduate School of Health and Sports Science, Juntendo University

PURPOSE: The purpose of this study was to investigate whether walking combined with blood flow restriction in working muscles (BFR) can elicit acute increase in muscle size and decrease in maximal strength as a result of metabolic fatigue in older adults.

METHODS: Ten older male and 8 older female (mean ± SEs; age 68±1years, height 161.8±1.8cm, weight 60.7±8.5kg) participated in this study. They performed 20 minutes of treadmill walking with BFR (BFR-walk) at a pre-determined exercise intensity of 70-85% of age-predicted maximum heart rate (HRmax: 220 - age). Nylon cuffs were applied tightly at the most proximal portion of both legs during an exercise session. The pressure value was calculated for each subject based on the circumference of the right thigh (33 % of the distance from the inguinal crease to the top of the patella) based on the previous study, as follows: <50 cm = 100 mmHg; 51-55 cm = 120 mmHg; 56-59 cm = 140 mmHg; >60 cm =160 mmHg. This is because arterial occlusion pressure is largely influenced by thigh circumference. Muscle thickness (MT) was measured via B-mode ultrasound using a 5-18 MHz scanning head (Noblus; Aloka, Tokyo, Japan) at the four following sites: knee extensors (KE) and flexors (KF) at 50% of thigh length and dorsi flexors (DF) and plantar flexors (PF) at 30% of lower leg length. The maximal voluntary isometric strength of KE was measured using a Biodex System 4 dynamometer at a fixed knee joint angle of 75°. Whole blood samples (20μl) taken from the earlobe were used to measure Blood lactate concentrations. All of these parameters were measured before and immediately after the exercise session. Differences of mean values were evaluated with two-tailed paired Student's t-test.

RESULTS: MTs were significantly increased in all sites after a bout of BFR-walk (KE: pre 28.9±1.0mm, post 32.3±0.9mm, KF: pre 53.3±1.2mm, post 55.2±6.0mm, DF: pre 23.9±0.6mm, post 24.7±0.5mm, PF: pre 61.0±1.1mm, post 63.8±1.0mm). Maximal voluntary isometric strength of KE was also significantly decreased after BFR-walk (pre 28.9±1.0mm, post 32.3±0.9mm). In addition, blood lactate concentration was significantly increased after BFR-walk (pre 1.3±0.1mol/l, post 1.9±0.2mol/l).

CONCLUSION: Walking combined with BFR elicits acute increase in muscle size and decrease in maximal strength in older adults.



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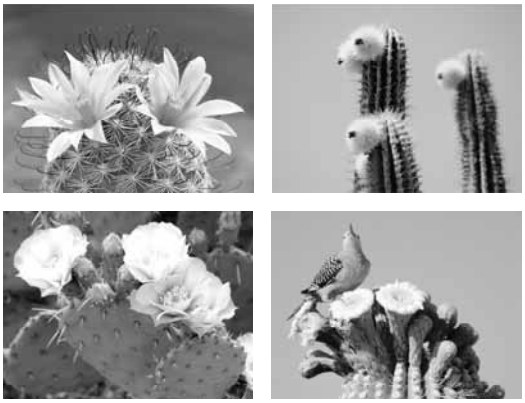

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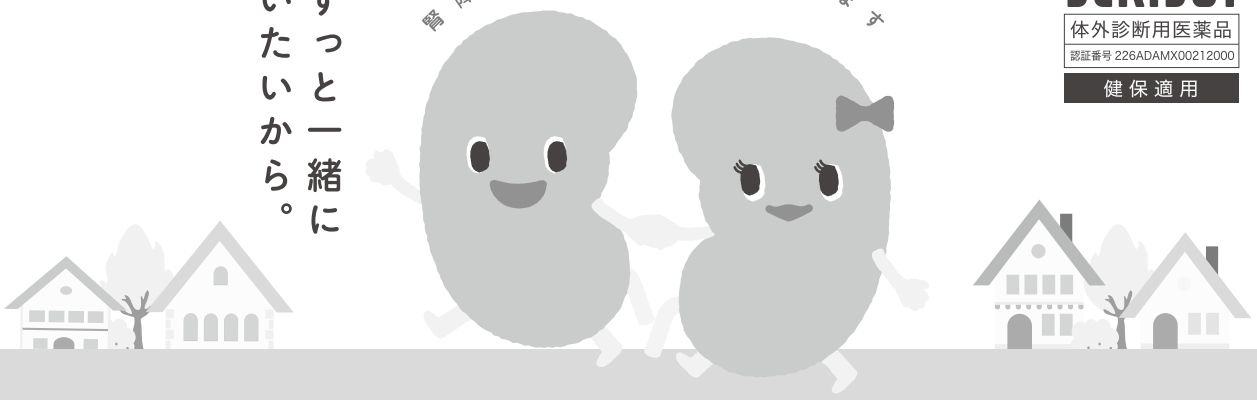

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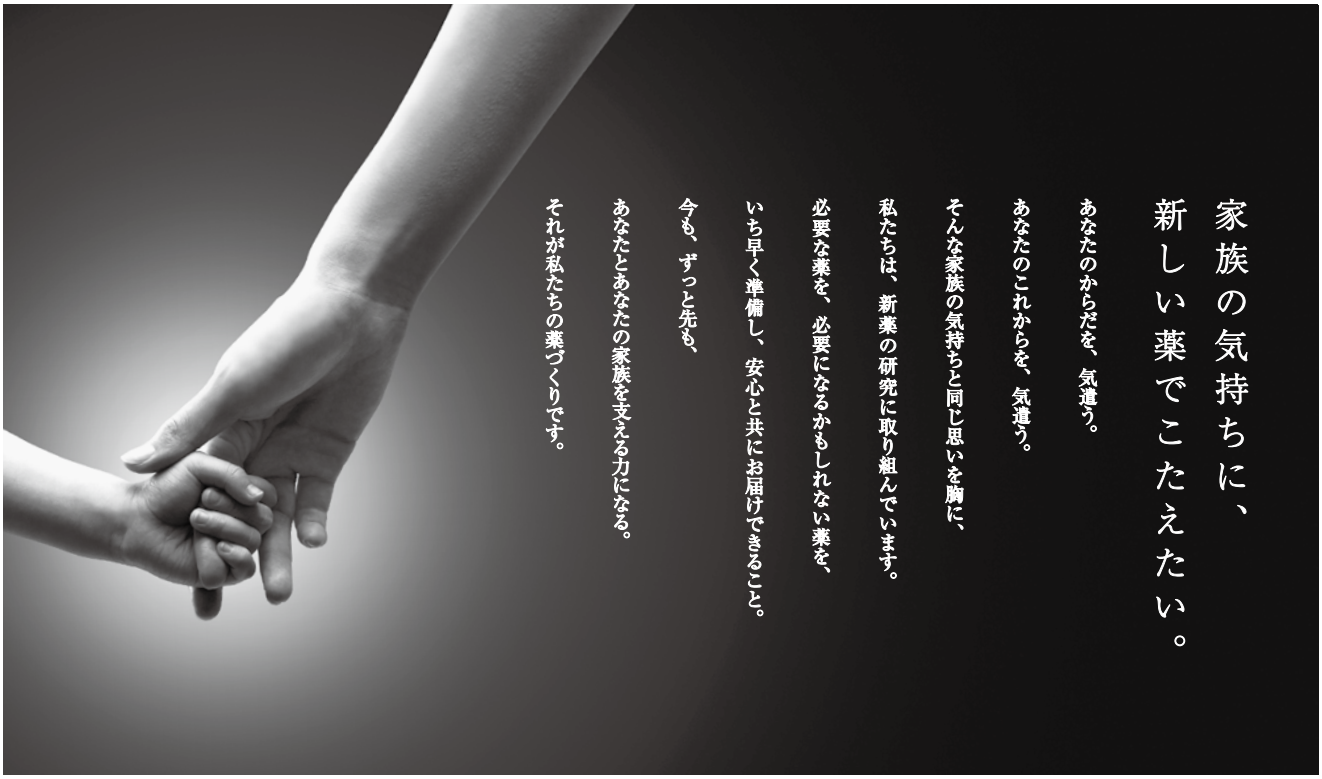

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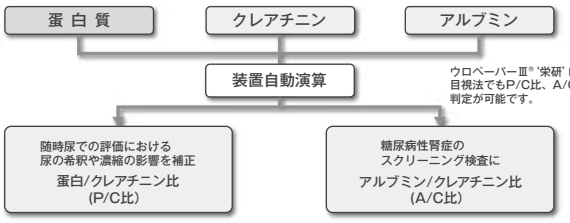

ウロペーパー®αⅢ'栄研'とウロペーパー®Ⅲ'栄研'にクレアチニン・アルブミン項目が追加されました。

蛋白尿、アルブミン尿の評価に有用な
蛋白/クレアチニン比(P/C比)、アルブミン/クレアチニン比(A/C比)の
報告が可能となりました。

ウロペーパー®αⅢ'栄研'11・7C

製品名	識別記号	包装単位	製品コード	適合機種
ウロペーパー®αⅢ'栄研' U,H,A,G,K,B,N,L,pH,C,MA	11	100枚×10	E-US33	全自動尿分析装置 US-3500 US-3100Rplus
ウロペーパー®αⅢ'栄研' U,H,A,G,pH,C,MA	7C	100枚×10	E-US37	

ウロペーパー®Ⅲ'栄研'12

製品名	識別記号	包装単位	製品コード	適合機種
ウロペーパー®Ⅲ'栄研' U,H,A,G,K,B,N,S,L,pH,C,MA	12	100枚 100枚×10	E-UR97 E-UR98	尿自動分析装置 US-2200（又は目視）

※ウロペーパー®αⅢ'栄研'およびウロペーパー®Ⅲ'栄研'には他の測定項目のラインナップもございます。詳細はお問い合わせください。
※ウロペーパー®αⅢ'栄研'およびウロペーパー®Ⅲ'栄研'のお問い合わせ、ご注文には識別記号をご利用ください。
※貯蔵方法：室温保存/有効期間：2年間

本試薬の使用上又は取扱い上の注意については、添付文書をご参照ください。

製造販売元
栄研化学株式会社
〒329-0114　栃木県下都賀郡野木町野木143番地

0057	BSC

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TEIJIN
Human Chemistry, Human Solutions

帝人ファーマ株式会社　〒100-8585 東京都千代田区霞が関3-2-1（霞が関コモンゲート西館）　http://www.teijin-pharma.co.jp/

アストラゼネカ株式会社　|　〒530-0011　大阪市北区大深町3番1号　|　http://www.astrazeneca.co.jp/　|

Better Health, Brighter Future

タケダから、世界中の人々へ。より健やかで輝かしい明日を。

一人でも多くの人に、かけがえのない人生をより健やかに過ごしてほしい。タケダは、そんな想いのもと、1781年の創業以来、革新的な医薬品の創出を通じて社会とともに歩み続けてきました。

私たちは今、世界のさまざまな国や地域で、予防から治療・治癒にわたる多様な医療ニーズと向き合っています。その一つひとつに応えていくことが、私たちの新たな使命。よりよい医薬品を待ち望んでいる人々に、少しでも早くお届けする。それが、いつまでも変わらない私たちの信念。

世界中の英知を集めて、タケダはこれからも全力で、医療の未来を切り拓いていきます。

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武田薬品工業株式会社

乳酸菌とともに
Yakult 80th

大好きな人に、ヤクルトを。

あなたがはじめて飲んだヤクルトは、
誰に渡されたものですか。
きっとその人は、あなたのことが大好きな人。
だってヤクルトは、
元気な毎日を過ごして欲しい人に、渡すものだから。
そのために、みんなに安心して飲んでいただける品質を
ずっと守りつづけてきました。
1本のヤクルトは、160項目の品質チェックをして、
お客さまのもとへお届けしています。
研究所で、工場で、販売所で、
今日もたくさんのスタッフが乳酸菌をみつめています。

誰もが願う すこやかな明日のために。

お客さま相談センター イイ ヤクルト
0120-11-8960（受付時間 9:00～17:30 土・日・祝日・年末年始を除く）


歩く芸術「ストランドビースト」。
オランダの芸術家テオ・ヤンセンが、単なる造形美ではなく、
風の力で生命を生み出すという革新的なアートを創り出した。
新しい世界はきっと、こんな見たこともない創造から始まる。
だからこそ私たちは国の壁を取り払い、
世界中の技術とノウハウを結集して常識とたたかい続ける。
同じ病気の人が100万人いれば、100万通りの答えを目指す。
できそうもない薬でなければ、私たちが生み出す意味はない。
創造で、想像を超える。
すべての革新は患者さんのために
CHUGAI 中外製薬
Roche ロシュ グループ


協和発酵キリン株式会社
http://www.kyowa-kirin.co.jp
Commitment to Life
救うこと。治すこと。そして笑顔をつくること。
わたしたちにできることは無限にある。
だからこそ、この瞬間にも病と闘っている人のために。
この地上でもっとも大切な「いのち」のために。
抗体医薬のリーディング・カンパニーとして、
新薬の開発と、まっすぐ向き合っています。
グローバル・スペシャリティファーマ。
抗体医薬をリードする、協和発酵キリンです。
KYOWA KIRIN