Saturday, July 26

Keynote Addresses

Physical Activity and Quality of Life in Older Adults: What We Know and What We Have Yet to Learn

Wojtek Chodzko-Zajko, University of Illinois at Urbana–Champaign

Over the past 25 years substantial scientific evidence has accumulated regarding the critical role of regular physical activity in preserving good health, functional independence, and high quality of life in old age. Initially, research focused on identifying appropriate and efficacious exercise prescriptions for individual older persons. Over the years, a wealth of evidence has accumulated about the physiological, psychological, and social benefits of regular physical activity. Gradually the attention of the scientific community began to focus beyond individual-level questions to address broader issues related to the promotion of physically active lifestyles at the community or societal level. In this keynote address, Chodzko-Zajko will present an overview of the evolution of physical activity and aging research from a field focused primarily on changing individual behavior to a much broader public-health-oriented discipline that attempts to address behavior change at the population level. Using the USA National Blueprint as an example of a coordinated national-level strategic plan, Chodzko-Zajko will argue that effective strategies to increase physical activity participation need to be both multidisciplinary and multisectoral in nature. The speaker will describe the work of a coalition of 50 health-related organizations and agencies that have jointly advocated for increased physical activity among older persons in the USA. The National Blueprint: Increasing Physical Activity Among Adults Age 50 and Older serves as a guide for organizations and agencies, to inform and support their planning work related to increasing physical activity among America’s older adults. The Blueprint Steering Committee consists of representatives of the National Institute on Aging, the National Council on the Aging, the Centers for Disease Control and Prevention, the American Geriatrics Society, the American College of Sports Medicine, and the Robert Wood Johnson Foundation. Key outcomes of the first 5 years of the project include the development and implementation of a comprehensive Internet-based resource and technical assistance center (www.agingblueprint.org), the identification of 18 strategic priorities for increasing physical activity among adults aged 50 and older and the assignment of lead organizations to direct each of the strategic priorities, and the development of a consensus public policy and legislative agenda for promoting physical activity among older adults. The speaker will argue that the National Blueprint is an example of how a coalition of public/private organizations can successfully raise the visibility of physical activity and aging-related issues and initiatives by advocating for public health interventions, by developing a legislative agenda, and by implementing a wide variety of community-based programs. In the final section of the keynote, Chodzko-Zajko will discuss future challenges for the field of physical activity and healthy aging. He will suggest that more research is needed to understand how physical activity programming can be integrated into...
a more “holistic” wellness model that acknowledges that healthy aging cannot be achieved by physical activity alone and that physical activity is only one of a number of elements of healthy living necessary to preserve health and quality of life in old age.

Secular Changes of Physical Function Among Community-Dwelling Elderly People in Japan: Experience From TMIG-LISA

Takao Suzuki, Tokyo Metropolitan Institute of Gerontology (TMIG)

The TMIG has been conducting the longitudinal interdisciplinary study on aging (TMIG-LISA) to examine the changes in physical function of the elderly, to identify factors retarding or accelerating the rate of aging and to establish ways for successful aging in elderly residents for 10 years. The subjects consist of 735 persons aged over 65 years living in a mountain-ringed rural community, Akita prefecture, in the northern part of Japan. The first survey was conducted in 1992. Since then, the same survey has been performed on the same persons every 2 years. In 2002, the fifth follow-up survey was conducted on 1,327 subjects including 303 subjects who participated at baseline survey in 1992. The survey involved medical examination of more than 100 parameters as well as interview. The present study analyzed 4 measurements (grip strength, one-leg standing time with eyes open, usual walking speed, and maximum walking velocity) concerning physical function that are important factors determining functional capacity. In a comparison of the 1992 and 2002 cohorts, close similarities in the distribution pattern of measurements in those over 65 years of the 1992 cohort were found in those over 69 years for grip strength, in those over 76 years for usual walking speed, and in those over 69 years for maximum walking speed in men and in those over 75, 76, and 73 years in women of 2002 cohort, respectively. From the results of the analysis, it was concluded that, in the 2002 cohort, men and women were functionally younger by 4–11 years and 8–11 years, respectively, compared with those in the 1992 cohort. Conventionally, “elderly” has been defined as a chronological age of 65 years old or older, while those from 65 through 74 years old are referred to as “young-old” and those over 75 years old as “old-old.” However, the evidence on which this definition is based is unknown. Our findings on longitudinal and cross-sectional changes of physical function from TMIG-LISA suggest that a definition of elderly to simply include all persons over 65 years might be no longer be appropriate in this era with a life expectancy of 80 years. What has increased is healthy life expectancy rather than simply the time spent alive, so there are more bright and energetic elderly people compared with a couple of decades ago in Japan. In addition, our recent findings on a few biological markers related to mortality and sarcopenia in the elderly from TMIG-LISA will also be introduced in the symposium. Recent Selected Publications: 1 Suzuki T, Shibata H: An introduction of The TMIG-LISA (1999-2001). Geriatr. Gerontol. International. 2003, 3: S1-4. 2 Suzuki T, Yoshida H., Kim H. Yukawa H., Furuna T., Sugiura M., Ishizaki T: Walking speed as a good indicator for maintenance of I-ADL among the rural community elderly in Japan: A 5-year follow-up study from TMIG-LISA. Geriatr. Gerontol. International. 2003, 3: S6-14. 3 Suzuki T, Kim H, Yoshida H, et al: Randomized controlled trial of exercise intervention for the prevention of falls in community-dwelling elderly Japanese women. J Bone Min. Metab. 2004, 22: 602-611. 4 Ishizaki T, Yoshida H, Suzuki T, Watanabe S and Kim H: Effects of cognitive function on functional decline among community-dwelling non-disabled older Japanese. Arch Gerontol Geriatr. 42: 47-58, 2006. 5 Kwon J, Suzuki T, Kumagai S, Yukawa H: Risk factors for dietary variety decline among Japanese elderly in a rural community: an 8-year follow-up study from

Symposium

**Masters Sport: The Inside Story**

Bevan C Grant, University of Waikato, Hamilton, New Zealand; Mary Ann Kluge and Linda Glick; University of Colorado, Colorado Springs, USA; Rylee Dionigi, Charles Sturt University, Bathurst, Australia

Each year more people over 60 years of age opt to compete in Masters sport. But being (or, becoming) a competitive athlete at this stage of life is never straightforward. What could and should the older body do? From the limited research on Masters sport it is evident that the experiences of older athletes across a variety of sports are expansive, dynamic and completely imbued with multiple interpretations. This symposium includes information about the growth of Masters sport worldwide and considers the challenges associated with participating in sport in the later years. Examples of the complexity of the experience of being an older athlete will be told through stories obtained from the presenters’ respective research. This includes a documentary that chronicles what it was like for a nonathletic 65-year-old woman who “leaps out of her decade” and trains for Senior Games track and field competition.
Relationship of Muscle Fatigue and Muscle Activity on Functional Performance Tasks in Older Adults


The loss of muscle strength and mass (sarcopenia) associated with advanced aging is well documented; however, the response of the aging neuromuscular system to repeated muscle activity or exercise (fatigue) is not well understood. Muscle fatigue is often described as either a decline in the muscle’s maximum force-generating capacity for strength related tasks (rise from a chair) or its failure to maintain adequate force production during repeated endurance related tasks (walking). The neuromuscular system of older adults is described to be more, or less fatigable than that of younger adults, but most laboratory-based fatigue studies utilize isometric fatiguing tasks to measure muscle force or torque because these static exercises are readily controlled and measured. Yet, such techniques do not measure muscle fatigue and activity associated with repeated dynamic tasks, which are arguably more functionally relevant since most activities of daily living (ADL) require submaximal, repetitive movements. This symposium includes 4 presentations by our collaborative group. The first presentation will review the current scientific literature related to muscle fatigue and neuromuscular function in older adults and will highlight recent studies that have assessed muscle fatigue through laboratory controlled dynamic tasks. Relevant neuromuscular factors also will be explored. The second presentation will describe the utility of using combined electromyography (EMG) and mechanomyography (MMG) recordings to simultaneously measure the electrical and mechanical properties of muscle from aged humans during laboratory-based isometric and dynamic fatigue tasks. The third presentation will illustrate the functionality of using chronic (8-hr) EMG recordings to assess electrical burst and gap activity during normal daily activities. Age and sex differences in long-term EMG activity will be examined. The final presentation will attempt to link the relevance of understanding muscle fatigue on functional performance (mobility) in older adults.

Special Workshop

The Making of a Senior (or Masters) Athlete: Training Considerations

Linda Glick and Mary Ann Kluge, Health Sciences, University of Colorado at Colorado Springs, USA

Successfully training older adults to become athletes for the first time or to return to athletic completion after a long hiatus requires special considerations. This workshop presents practical information and practice examples of what to do to help older adults who have been inactive for some time 1) get started being physically active and 2) to ultimately participate in athletic competition. A first-time senior athlete and her trainer/coach will talk about the range of opportunities available for sports competition in the later years. They will share their experiences, suggest some useful strategies, and demonstrate (audience participation is encouraged) what to do during the 5 phases of preparation for competition: 1. Mobilizing (the individual). 2. Gearing Up. 3. Adding On. 4. Building Up (to competition). 5. The
Competition (GAMES). Information will include how to recruit participants, how to choose activities and design progressions that lead to desired skill/sport outcomes, suggestions for mental and emotional skills training, and social support strategies. Video footage of this first-time athlete training and competing will be used to illustrate several common themes, specific challenges, and vulnerabilities that might arise for older adults who are or who want to be physically active and compete in athletics.

Oral Presentations

Epidemiology of Physical Activity and Aging

Physical Activity and General Health in an Elderly German Cohort

Timo Hinrichs, Department of Sports Medicine and Sports Nutrition, Faculty of Sports Sciences, Ruhr-University Bochum; Ulrike Trampisch, Department of Sports Medicine and Sports Nutrition, Faculty of Sports Sciences, Ruhr-University Bochum, Federal Republic of Germany; Heinz Endres, Ina Burghaus, Renate Klaassen-Mielke, Department of Medical Informatics, Biometry and Epidemiology, Ruhr-University Bochum, Germany; Margitta Lungenhausen, Department of Pain Management, BG-Klinken Bergmannsheil, Ruhr-University Bochum, Germany; Petra Platen, Department of Sports Medicine and Sports Nutrition, Faculty of Sports Sciences, Ruhr-University Bochum, Germany.

Objective: Although the benefits of physical activity for health and functioning are recognized to extend throughout life, data on physical activity habits of elderly people are scarce. The aims of this study were: 1. To evaluate the association between general health and physical activity in elderly people 2. To perform a detailed analysis of the sporting and leisure time activities in a cohort of elderly people in Germany. Methods: In a monitored prospective cohort study (German epidemiological trial on ankle brachial index, getABI), 6,880 unselected patients ≥65 years were followed up by 344 representative primary care physicians in Germany since November 2001. In the 5-year follow-up, 2,120 patients (median age 76; 70–94 years; 53.7% women) of the cohort were interviewed about their level of physical activity (activity of moderate intensity for at least 30 min per session): 1: no activities or active less than once per week, 2: active 1–3 times per week, 3: active >3 times per week) and on their general health (1: excellent to 6: very poor). In a subgroup of 1,376 patients (median age 76; 70–94 years; 54.7% women), a detailed analysis of sporting and leisure time activities was performed. Results: Of the 2,109 (out of 2,120) patients who answered the questions on activity level and on general health in the 5-year follow-up, 57.4% reported a high activity level (level 3), 23.2% an intermediate activity level (level 2), and 19.4% reported to be inactive (level 1). Women and men did not differ significantly in their reported activity level. Activity level was associated to self-reported general health of the previous 4 weeks. The better the health status, the higher was the specified level of physical activity (Stuart’s tau-c = -.15, p < .001), e.g., 70.1% of the 107 patients with “excellent general health” were physically active more than 3 times per week, whereas only 34.9% of the 63 patients with “poor general health” reached the same activity level. The detailed analysis of sporting and leisure-time activities in the subgroup of 1,376 patients showed that 73.7% had taken an outdoor walk and 18.8% had made a bicycle tour or ridden on a bicycle ergometer during the previous week. During the previous month, 24.8% of patients had participated in gymnastics or strength training, 16.6% had swum, and 6.2% had bowled or danced. Every other sporting activity had been performed by less than 5% of patients during the previous week.
month. **Conclusions:** The level of physical activity is associated with self-reported general health in elderly people. Only a small percentage of elderly people do sporting activities other than walking, cycling, gymnastics, strength training, swimming, bowling, or dancing. *The study has been conducted within the research cooperation PRISCUS (“Prerequisites for a new health care model for elderly people with multimorbidity”), which is funded by the German Federal Ministry of Education and Research (01ET0720).*

### A 7-Year Prospective Study of Leisure-time Physical Activity and Depressive Symptoms in Older Adults

Po-Wen Ku, Graduate Institute of Sports and Health, National Changhua University of Education, Taiwan; Li-Jung Chen, Department of Leisure and Recreation Management, Nan Kai Institute of Technology, Taiwan

**Background:** Previous cohort studies examining preventive effects of physical activity on depression in the elderly yielded inconsistent findings. It can be argued that the conflicting results may be related to some issues, including a small unrepresentative sample, a short follow-up period, not including underlying confounders, and ignoring the selection bias derived from those lost to follow-up. This study aimed to explore the dose-response relation between leisure-time physical activity and incident depressive symptoms using a 7-year population-based sample with more comprehensive covariates. **Methods:** The analyses were based on nationally representative data from the longitudinal Survey of Health and Living Status of the Elderly performed by the Bureau of Health Promotion, Department of Health, in Taiwan. The five-wave surveys have been consecutively conducted since 1989 through three-stage equal-probability sampling design and household interviews. Without including deceased cases, response rates ranged between 81.2% and 92.2%. Among the 5,131 persons in 1996, the fixed cohort of 3,778 participants (male: 53.9%) age 50 and older at baseline in 1996 with 7 years of follow-up was analyzed. Depressive symptoms (outcome variable) were measured using the Chinese version of CESD-10 (Center for Epidemiological Studies Depression Scale). Incident cases (CESD-10 score ≥ 10) in 2003 totaled 420 (14.3%) among the 3,063 subjects who were not scored as depressed in 1996. The weekly sessions of leisure-time physical activity (exposure variable) were self-reported. Covariates at baseline for adjustment comprised sociodemographic factors (age, gender, education level, marital status, living status, satisfaction with income, and satisfaction with social support), lifestyle behaviors (alcohol consumption and smoking), and health status (activities of daily living and number of having chronic diseases). All variables except smoking were found to be significantly associated with incident depressive symptoms from 1996 to 2003 (n = 3,063) in chi-square testing (p < .05). Variables showing significant associations were then entered into the multivariate logistic-regression model simultaneously for predicting incident cases (1 = yes, 0 = no; model fit: Omnibus model $\chi^2$ test, $p < .001$; Hosmer and Lemeshow test, $p = .15$). To examine the influence of missing data, sensitivity analysis was conducted using SPSS missing-value analysis. Little’s MCAR (missing completely at random) test indicated the missing pattern is not random ($p < .05$). The missing values of the depressive-symptom scores in 2003 were estimated and replaced using EM (expectation maximization based on maximum likelihood estimation). **Results:** The multivariate logistic-regression analysis indicated that individuals engaging in leisure-time physical activity less than three times per week in 1996 had the higher risk of subsequent depressive symptoms in 2003 (AOR = 1.35, 95%CI: 1.06–1.73; reference three or more sessions per week). After replacing the missing values of depressive symptoms in 2003, the evidence of supporting of an association became
weaker (AOR = 1.06, 95%CI: 0.84–1.35). **Conclusions:** With adjustments of sociodemographic variables, lifestyle behaviors, and health status, leisure-time physical activity may provide protective effects on incident depressive symptoms in older adults. However, the influence seems weak. Moreover, the selection bias from those lost to follow-up (direction: away from the null) cannot be underestimated.

**Relative Body Strength as a Determinant of Physical Capacity in Elders: Nutrition as a Determinant of Successful Aging (NuAge)**

Stephane Choquette, Kinanthropology, University of Sherbrooke; Isabelle J. Dionne, Martin Brochu, Danielle R. Bouchard, Martin Senechal, Caroline Y. Doyon, Kinanthropology, University of Sherbrooke, Canada

**Background.** The loss of strength with concomitant increases in body fat can result in overweight individuals being too weak to carry their own body weight efficiently. While the impact of obesity and muscle weakness on disabilities has been studied extensively, few have tried to assess the relation of strength relative to adiposity with physical capacity of elders. **Objective.** To determine the association between relative strength and physical capacity in elders. **Methods.** In this cross-sectional study, body composition (DXA) and muscle strength (biceps, quadriceps, and handgrip) were obtained from baseline data of the NuAge longitudinal study for 904 men and women between 67 and 84 years old. Physical capacity was computed as a global mobility score (GMS) including five lower extremity function tests (TUG, chair stand, walking speed at normal and fast pace, and one-leg stand). The relationship between strength, body composition, and physical capacity was examined using multiple-regression models. **Results:** The relative strength ratio that yielded the best correlation with GMS was overall strength (sum of maximal strength for biceps and quadriceps) on body-mass index (BMI). Correlation between relative strength and GMS was $r = .46$ for men and $r = .54$ for women ($p < .001$). Correlation with GMS was lower for measures of body composition, such as BMI ($r = -.20$ for men and $-.23$ for women, $p < .001$), muscle-mass index ($r = .12$ for men and $-.02$ for women, $p < .001$), or percent fat mass ($r = .30$ for men and $-.21$ for women, $p < .001$) and for measures of strength such as biceps ($r = .25$ for men and $-.36$ for women, $p < .001$), quadriceps ($r = .32$ for men and $-.42$ for women, $p < .001$), handgrip strength ($r = .29$ for men and $-.31$ for women, $p < .001$) or overall strength ($r = .35$ for men and $-.45$ for women, $p < .001$). Relative strength alone explained 21% of the variability observed in GMS in men and 29% in women (both $p < .001$). When entered in a stepwise regression model including age, physical activity, and sum of chronic conditions, relative strength remained the most important predictor for men (partial $r = .46$, $p < .001$) and women (partial $r = .54$, $p < .001$). **Conclusion:** Relative strength may be more useful to explain physical capacity than muscle-mass index, BMI, percent fat mass, or overall strength. Longitudinal studies are necessary to identify relative strength cut points representing an increased risk of disability in elders.

**Relation Between Trail Making Test Scores and Physical Function in the Community-Dwelling Elderly**

Hirota Chika, Department of Hygiene and Public Health, Osaka Medical College; Misuzu Watanabe, Yoshimi Tanimoto, Rei Kono, Kan Usuda, Koichi Kono, Department of Hygiene and Public Health, Osaka Medical College, Japan

**Aim:** Previous studies have shown an association between Trail Making Test (TMT) scores and timed up-and-go (TUG) with a cup in the young elderly, and between TMT scores
and age in the old elderly. Results suggest that TMT scores are associated with executive function in the community-dwelling elderly. The purpose of this study was to determine the relation between TMT scores and physical function in the community-dwelling elderly. The young elderly are people age 65 years or more and less than 75, and the old elderly are people age 75 years or more. **Methods:** The study was carried out in T-city in April and May 2007. Subjects were 189 individuals age 65 years or more (61 men and 128 women, age range, 65–89 years). The TMT was given to each subject, and 13 physical functions were measured: walking speed on a 5-m course at usual pace, walking speed on a 5-m course at maximum pace, walking speed on a 10-m obstacle course at fast pace, time to climb steps at fast pace, time to stand up from a chair, time standing on one foot, TUG, TUG with a cup, bone mass, biting power, chewing ability, muscle mass, and number of steps walked in 1 day. The difference score between TMT Part A and TMT Part B (delta TMT score) was used for analysis. The data were analyzed on the basis of gender and age. **Result:** Mean delta TMT was 69.13 ± 40.2 s in men and 82.65 ± 51.4 s in women. There were significant differences between the young elderly and the old elderly of sexes. TMT scores correlated significantly with TUG, TUG with a cup, and number of steps walked in 1 day in young elderly men and with walking speed on a 5-m course at maximum pace in old elderly men ($p < .05$). TMT scores correlated significantly with TUG, TUG with a cup, and time to climb steps in young elderly women and with TUG with a cup, walking speed on an obstacle course, time to climb steps at fast pace, and time to stand up from a chair in old elderly women ($p < .05$). Stepwise multiple-regression analysis revealed that time to climb steps in young elderly men and maximum walking speed in old elderly men affected the TMT scores significantly. In young elderly women, biting power affected the TMT scores significantly. In old elderly women, muscle mass affected the TMT scores significantly. **Conclusion:** The study results show that TMT scores are associated with physical skills and the basic strength that relates to walking in the community-dwelling elderly.

**Activity-Specific Cautiousness and Balance Performance in Older Adults in Relation to Fear of Falling**

Wen-Chieh Yang, Department of Physical Therapy, National Cheng Kung University; Chien-Fen Liao, Institute of Allied Health Science, National Cheng Kung University, Tainan, Taiwan; Marcella Mun San Kwan, Stephen R. Lord, Prince of Wales Medical Research Institute, Randwick, Sydney, Australia; Sang-I Lin, Institute of Allied Health Science, National Cheng Kung University, Tainan, Taiwan

**Background:** Activity-specific cautiousness refers to the degree of extra attention paid to performing a task out of concern for falling. Such behavior is often seen in older adults and could be related to balance performance. Fear of falling, which represents fall-related anxiety, could also possibly be associated with both cautiousness and balance. The aim of this study was to investigate whether there is an association between activity-specific cautiousness and balance performance and how the association could be affected by fear of falling. **Method:** Sixty-five community-dwelling older adults participated in the study and went through six balance performance tests, including maximum voluntary sway range, lowest chair height to raise, and timed near-tandem stance, one-leg stance, sit-to-stand for five repetitions, and up-and-go. The Fall Efficacy Scale International (FES-I) was used to assess the degree of activity-specific cautiousness. The level of fear of falling was assessed by a 5-point Likert scale, based on which subjects were classified into three groups, NO-Fear (no fear at all), LOW-Fear (a little bit), and HIGH-Fear (moderate, quite a lot, extreme fear). Between-group differences were examined by one-way ANOVA. The data of the six actual balance tasks
were transformed into a performance index by principal-components analysis and used in the Pearson correlation to determine its association with the FES-I score in the three groups individually. Fisher’s z test was then used to compare the between-group difference in correlation coefficients. **Result:** The three groups did not differ significantly in age, sex, or previous history of falling. The NO-Fear group had significantly lower FES-I scores than either the LOW- or HIGH-Fear group \( (p < .001) \). The NO-Fear group also performed significantly better than the other two groups in timed near-tandem stance and sit-to-stand for 5 repetitions \( (p < .001) \). For the association between cautiousness and balance performance, significant correlations were found in the LOW- \( (r = .66) \) and HIGH-Fear \( (r = .81) \) groups but not in the NO-Fear group \( (r = .18) \). All the between-group differences in the correlation coefficient of cautiousness and balance performance reached significance \( (p < .001) \).

**Discussion and Conclusion:** The study showed increased strength of correlation between degree of cautiousness and balance performance with increasing fear of falling in older adults. Fear of falling has been shown to be related to poor balance performance. A greater fear of falling might lead to greater self-imposed restriction in activity, which in turn could lead to poorer balance and consequently even greater fear of falling. Such a vicious circle might explain why stronger association between cautiousness and balance performance was found in elders with greater fear of falling. Different associations between activity-specific cautiousness and balance performance in relation to fear of falling should be taken into consideration when assessing and planning fall-prevention programs.

**Comparison of Balance and Some Other Physical Characteristics Between Elderly Fallers and Nonfallers**

Gerd Wivi Helena Laxaback, University of Jyvaskyla, Chydenius-Institute; Magnus Bjorkgren, Frank Borg, Pia Vahakangas, Petra Lahtonen, University of Jyvaskyla, Chydenius-Institute, Finland

The present paper reports a retrospective study on differences between a group of elderly fallers (F) and a group of elderly nonfallers (NF). Participants \( (F: n = 37, \text{age } = 82.4 ± 6.1; \text{NF: } n = 58, \text{age } = 79.9 ± 7.6) \) were recruited from community-dwelling home-health-care clients aged 65 or older. Participants were classified as fallers (F) and nonfallers (NF) based on their fall history. Those who had not fallen during the past 12 months as nonfallers were categorized. Static and dynamic balance tests were conducted using the balance platform, complemented with a Berg Balance Scale (BBS) test, visual gait analysis, and strength measurements. Significant \( (p < .05) \) differences between the groups were found for mediolateral sway while standing on foam \( (F: 9.2 ± 4.6 \text{ mm}; \text{NF: } 7.3 ± 1.8 \text{ mm}) \). Significant differences were also found for weaker leg isometric extension \( (60° \text{ flexion}) \), women \( (F: 48.6 ± 21.3 \text{ Nm}; \text{NF: } 60.7 ± 21.6 \text{ Nm}) \); BMI \( (F: 27.1 ± 4.9; \text{NF: } 29.6 ± 5.3) \); body mass \( (F: 67.9 ± 14.6 \text{ kg}; \text{NF: } 76.9 ± 15.2 \text{ kg}) \); fast-speed gait, women \( (F: 0.73 ± 0.29 \text{ m/s}; \text{NF: } 0.94 ± 0.41 \text{ m/s}) \); and for the sum of the four last items of the BBS test \( (F: 5.19 ± 3.48; \text{NF: } 7.51 ± 4.2) \). Average isometric leg-extension torque per body weight kilogram was \( 1.01 ± 0.06 \text{ Nm/kg (women)} \) and \( 1.09 ± 0.09 \text{ Nm/kg (men)} \), which may provide benchmark values for this age group. It can be hypothesized that the increased lateral sway for fallers may indicate that it is more difficult to correct lateral sways, which therefore imply a greater fall risk. The smaller BMI for fallers may indicate that increased fall risk is part of the age-related frailty syndrome involving an increased vulnerability to stressors. Finally, lower BBS scores for fallers are related to problems in shifting weight between the legs. There were significant negative correlations between
lateral sway (foam) and BBS score (F: –.44; NF: –.48). An important risk factor was also related to hypotension syncope. These findings suggest an abridged fall-risk test battery and prevention training program.

Age-Related Trends in BMD and Body Composition in Korean Women: A Cross-Sectional Study

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Numerous studies have reported age-related increases in body weight and fatness and decreases in bone mineral density (BMD) after young adulthood. However, age-related trends in BMD and body composition among Koreans have not been studied sufficiently. A total of 208 healthy, sedentary women, age between 20 and 79 years, were recruited for this study. A cross-sectional study by age was designed to evaluate and describe the bone-mineral content (BMC), BMD, and body composition. A QDR-1000PLUS (Hologic, USA) was used to measure the BMC and BMD in segments L1–L4 of the lumbar spine. Percent body fat was measured by a body-fat analyzer (Tanita, Japan), and body-mass index was calculated by measurement of the height and body weight. These results showed that with advancing age, BMD was negatively correlated with age (–.568) and height (–.412) and positively correlated with weight (.187). Increasing age is significantly associated with loss of BMD. This study suggest that the factors examined as determinants of bone mass in this study could not completely explain the loss of BMD with age, since the level of physical activity and diet were not investigated. Therefore, systemic factors such as hormones, growth factors, vitamins, and minerals, coupled with environmental factors such as diet and exercise, as well as physiological factors such as muscle mass and strength, need to be further studied.

Falls, Walking Ability, and Physical Activity in the Elderly

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Introduction: The incidence of falls in people over 65 years of age who are living in the community is high. Falls often have serious consequences in older persons and may result in sustained disability and in loss of autonomy. The result can be a vicious cycle for the patient: On the one hand disability limits physical activity; on the other hand activity and exercise are essential to prevent further falls. This study reports on the associations between self-reported falls, walking ability, and physical activity in elderly people. Methods: In a monitored prospective cohort study (German epidemiological trial on ankle brachial
index, getABI), 6,880 unselected patients ≥65 years were followed up by 344 representative primary care physicians in Germany since November 2001. In the 5-year follow-up, 2,120 patients (median age 76; 70–94 years; 53.7% women) of the cohort were interviewed about their level of physical activity (activity of moderate intensity for at least 30 min per session): 1: no activities or active less than once per week, 2: active ≥1 time per week) and on the occurrence of a fall during the previous 3 months. Moreover, they were asked if they had been able to walk without a walking aid during the previous 4 weeks (2,111 of all patients answered these questions). \textbf{Results:} 80.7% of the 2,111 patients reported to be active (level 2). 8.2% had experienced a fall during the previous 3 months, and 13.4% even suffered a fracture following their fall. 10.1% of patients were not able to walk without an aid in the 4 weeks before the interview. A log linear model concerning fall status, ability to walk, and the activity showed that there was no significant relation between activity level and fall status (7.8% of falls among level 1 versus 9.8% among level 2; \(p = .65\)), as well as no three-way interaction (\(p = .97\)). However, there was a strong association (\(p < .001\)) between activity level and walking ability, as well as between fall status and ability to walk (\(p < .001\)). 7.3% of the 1,897 patients without a walking aid had experienced a fall, whereas 16.4% of the 214 patients who were not able to walk without an aid had experienced a fall. \textbf{Conclusion:} The incidence of self-reported falls and the prevalence of impairment measured by the inability to walk without an aid are high in elderly people. As expected, the ability to walk independently was associated with the level of physical activity. Furthermore, the frequency of falls seems to be reduced when a person is able to walk without an aid. There seems to be no relevant association between fall status and activity level. Considering the relevance of regular physical activity for health, the preservation of walking ability should be a major aim in elderly health care. The study has been conducted within the research cooperation PRISCUS (“Prerequisites for a new health care model for elderly people with multimorbidity”), which is funded by the German Federal Ministry of Education and Research (01ET0720).

\textbf{Functional Capacity and Falls Among the Elderly in Chennai, India}

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The present study examined the fitness level and incidences of falls among the elderly in Chennai, India. The sample included 207 elderly adults (91 males and 116 females), and the participants ranged in age from 60 to 106 years, with a mean age of 71. Physical tests were carried out to assess mobility (timed up-and-go), balance and flexibility (functional reach), lower extremity strength (sit-to-stand), and functional endurance (6-min walk). Incidence of falls within the last year was recorded using a single item question. The mobility scores ranged from 6 to 105 s with an average of 19 s. Men in the study had lower mobility compared with women. Functional reach scores also differed based on gender with men having greater functional reach compared with women. The lower extremity strength scores assessed using sit-to-stand (5 repetitions) ranged from 9 to 85 s with an average time of 22 s. In the current study, one third of the participants were unable to complete the 6-min walk test, which measures functional endurance. In addition, approximately half of participants recorded ever having had a fall (100 out of 207): 69 fell only once while 31 fell multiple times. Furthermore, the results showed a significant relationship of the functional indicators and falls. The findings have implications for the development of physical activity and falls prevention programs for seniors in low-income countries.
Physical Training for Middle-Aged and Older Adults

Antioxidant Supplements Combined With Resistance Exercise: Beneficial Effects on Fat-Free Mass Gains in Healthy Elderly Subjects

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Aging is associated with progressive muscle wasting, known as sarcopenia. Resistance training has been shown to be the most effective exercise mode to induce anabolic adaptations and delay sarcopenia. However, strenuous exercise promotes oxidative stress, which may diminish the efficiency of resistance exercise to promote fat-free mass gains in elderly. We sought to determine the effects of a combination of antioxidant supplements and resistance training on fat-free-mass gains in elderly subjects. Sixty-three healthy elderly men and women (age 60–75 yr) were randomized in a double-blind manner to one of four groups—placebo, placebo + resistance training (RT), antioxidant, and antioxidant + RT—to participate in a 6-month intervention of resistance training (3 days/wk) or no exercise and either antioxidant supplements (400 UI of vitamin E and 1,000 mg of vitamin C daily) or a placebo. Total fat-free mass (FFM) and muscle-mass index (MMI: FFM/m^2) were obtained by dual-energy X-ray absorptiometry (DXA) before and after the 6-month exercise program. Three-day dietary records provided dietary intakes. FFM and MMI were significantly increased after the intervention in the antioxidant + RT group only (p < .01), while other groups remained unchanged (even when adjusted for gender). Our results suggest that vitamin C and E supplements may potentially maximize the effect of resistance training on muscle mass in elderly individuals. Our results support further investigation of the impact of antioxidant supplements on preventing sarcopenia.

Effect of Resistance Training and Vitamin Antioxidant Supplementation on Insulin Sensitivity in Older Men and Women

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Introduction: Aging is associated with alterations in body composition and insulin metabolism that could lead to type 2 diabetes. Aerobic exercise is related to a decrease of fat mass, while resistance exercise is known to tend to increase fat-free mass, particularly muscle mass. Moreover, vitamin antioxidant supplementation is known to improve antioxidant status and insulin sensitivity. While these effects are well established in young individuals, the combined effect of resistance training and vitamin antioxidant supplementation on insulin sensitivity in the elderly remains unclear. The aim of this study was to evaluate the combined effect of resistance training and antioxidant supplementation on insulin sensitivity in older men and women. Methods: Sixty-two healthy men and women, age 65.7 ± 3.8, were divided into 4 groups: control, resistance training (3 sets of 8 repetitions at 80% of 1-RM; 3 days/week
during 6 months), vitamin antioxidant supplementation (vitamin C: 1,000 mg/d; vitamin E: 600 mg/d), and a combination of resistance training and vitamin antioxidant supplementation. Insulin sensitivity (intravenous glucose tolerance test) and body composition (dual X-ray absorptiometry) were determined at baseline and after 6 months of intervention. An ANOVA was performed to determine difference among groups at baseline, a repeated-measures ANCOVA using gender as a covariate to evaluate treatment effect after 6 months, and Pearson’s correlations to examine relation between changes in variables. Results: At baseline, no differences were observed among groups for any variables. When gender was used as a covariate, no treatment effect was observed on variables of interest, except for muscle-mass index. Moreover, no correlation was found between changes in any of the variables (i.e., insulin sensitivity and visceral fat mass or muscle mass). Conclusion: A 6-month resistance program combined with vitamin antioxidant supplementation in healthy older individuals seems to have no impact on insulin sensitivity, although it appeared to be beneficial for muscle-mass gains. Nevertheless, high-intensity resistance training was well tolerated and should be recommended for other purposes. A similar study would be interesting to verify the impact of these interventions in prediabetic subjects to improve body composition and insulin sensitivity. This study was supported by CDA.

Physical Activity Programs for Middle-Aged and Older Adults

The Effects of Exercise Counseling on Daily Physical Activity in Nonintrinsically Motivated Sedentary Older Adults in The Netherlands

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Background and Aim: About 40% of older adults in The Netherlands are sedentary according to the ACSM’s criteria. It is suggested that the enhancement of physical activity by lifestyle physical activity is an adequate instrument for nonintrinsically motivated sedentary subjects. The purpose of this study was to determine the effects of a pedometer-based lifestyle program with exercise counseling (the COACH program) on daily physical activity in sedentary nonintrinsically motivated older adults in the northern region of The Netherlands. Methods: A balanced randomized clinical trial (RCT) design was used. Inclusion criteria were being between 50 and 70 years of age and being sedentary and nonintrinsically motivated to enhance physical activity. In this study 473 healthy older adults were enrolled: 292 in the experimental group, 181 in the control group. The experimental group followed a physical activity counseling program with feedback from a pedometer during 11 weeks. One hundred fifty adults participated in an individual counseling program, and 142 subjects had a group counseling program. The outcome measures were daily physical activity (steps/day), physical fitness (Senior Fitness Test), and quality of life (RAND-36). Results: A MANOVA analysis show a statistical significant group × time effect in physical activity (number of steps; $F = 5.88, \alpha = .02, \beta = 90$), leg strength ($F = 2.01, \alpha = .04, \beta = 77$), endurance ($F = 3.53, \alpha = .03, \beta = 81$), systolic blood pressure ($F = 1.96, \alpha = .04, \beta = 76$), physical functioning ($F = 3.18, \alpha = .03, \beta = 82$), and vitality ($F = 4.18, \alpha = .02, \beta = 91$). The increase in steps show a clinical relevant change (ES .98). No statistically significant effect on physical activity was found between individual and group counseling ($F = 0.77, \alpha = .38, \beta = 83$). Conclusion: This study shows that exercise counseling is an efficacious instrument to enhance daily physical activity, physical fitness (leg strength, endurance, and systolic blood pressure), and quality of life (physical functioning and vitality).
**Keeping Elderly With Mild Cognitive Impairment Physically Active: Determinants of Maintenance**

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**Objective:** The FACT study (Folate physical Activity Cognition Trial) was designed to evaluate the effect of physical exercise (i.e., moderate intensive walking) and vitamin B supplementation in adults with mild cognitive impairment, compared with placebo pills and a low-intensity placebo activity program. The duration of the intervention was 12 months. Six months after the end of the intervention a follow-up was carried out to determine 1) level of maintenance of physical activity (PA; i.e., daily general PA and specific intervention activity) and 2) which determinants influence maintenance of PA.

**Methods:** Measurements at baseline in subjects who finished the FACT study (N = 138): background (sex, age, education, marital status), level of cognitive function (MMSE), and PA (Longitudinal Aging Study Amsterdam physical activity Questionnaire: LAPAQ, measures daily PA during the past 2 weeks). Participants were contacted at 6 months follow-up for a telephone interview concerning their current daily physical activity level, barriers for PA, lapses in PA during the intervention period, and satisfaction with the intervention. A regression analysis was carried out to evaluate the contribution of personal (demographic, cognitive) and program-related (quality) aspects to maintenance at follow-up.

**Results:** 134 follow-up interviews were conducted (1 died, 3 could not be contacted): 41% female, 25% lived alone. Average MMSE score at baseline was 28.4 (SD 1.4; range 24–30), indicating reasonable cognitive functioning as expected in an MCI population. About 1/3 of participants had lapses during the intervention period but completed the program (most stated reasons for lapses: holidays, illnesses, physical complaints, and other activities), 1/3 had no lapses and completed the program, and 1/3 dropped out during the intervention. At the end of the study about 25% continued with the walking or placebo activity, 14% expressed intention to start again, and about 61% had no intention at all to continue (most stated reasons: lack of time, injury, health complaints, practical limitations of activity [location, time of day] and advice of physician). Having dropped out (p < .001) and a lower level of adherence (p < .001) during the intervention were associated with discontinuing the program after the intervention ended. Participants who continued rated several quality aspects higher (guidance, contents, intensity, cost, and progress; p < .5) but did not show a higher general satisfaction (p = .174).

**Conclusions:** It can be concluded that maintenance of PA after exercise programs end is difficult, especially for dropouts and participants with low adherence. Possible improvements include quality aspects such as contents, intensity, and guidance.
Effect of a Community Walking Intervention on Exercise Self-Efficacy Among Older People: A Randomized Controlled Trial

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Objective: Existing evidence of the effect of physical activity intervention on exercise self-efficacy is weak, and few studies have been carried out to investigate the effect of this among older people. A community walking intervention (CommWalk) was carried out in Taiwan to examine the effect on exercise self-efficacy among older people. Method: A randomized controlled trial design was applied to evaluate the intervention program. Participants randomized to the intervention group received 6 months of the CommWalk based on self-efficacy theory. Both face-to-face and telephone support designed to help participants increase their exercise self-efficacy and walking were carried out by a researcher with a public health nursing background. Control group participants received usual community health care. Study outcomes were changes in exercise self-efficacy scores and self-reported walking frequencies. Results: At 6-month follow-up, mean improvement in exercise self-efficacy scores was found to be greater among the intervention group. The mean change in exercise self-efficacy scores was an increase of 2.1 and 0.8 in the intervention and control group, respectively (mean difference 1.2, 95% CI, 0.5–2.0, \( p = .001 \)). Intervention group participants were also more likely to report walking more during 6-month intervention period. Conclusions: The theory-based CommWalk appeared to have an effect on exercise self-efficacy among older people. Public health nurses can play an important role in enhancing older people’s confidence in adopting and maintaining regular walking as exercise through a community walking intervention using self-efficacy theory. Future work is warranted to investigate the feasibility of the intervention program when applied by public health nurses in various community settings.

Effects of Jazzercise on Physical Fitness and Body Composition in Elderly Women

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Background: The goals of an exercise program are different for elderly adults. However, the most important focuses are health and maintenance of function to pursue everyday activities safely and independently without undue fatigue. Jazzercise is a combination of jazz dance and exercise. Jazzercise allows for changes in the jazz, which requires professional and difficult techniques into easy, light, and practicable movements by using Korean popular music so that even elderly people can easily practice it. Purpose: This study investigated the effects of jazzercise on physical fitness and body composition in elderly women. Methods: The subjects of this study were in their 60s and 70s (\( N = 22 \)) and worked out at a senior center located at the Seoul metropolitan area in South Korea. They were divided into two groups: 60s (\( n = 11 \), average age = 64.63 ± 3.10) and 70s (\( n = 11 \), average age = 72.18 ± 2.27). The jazzercise program was designed for an RPE intensity of 11–13, 40–60 min/day and 3 times/ week for 12 weeks. Fitness test items were muscular endurance (chair stand, arm curl), flexibility (back scratch, chair sit-and-reach), balance (8-ft up-and-go, and one-legged
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standing with closed eyes) and aerobic capacity (6-min walk). Body composition included measures of percent fat and LBM (lean body mass). The collected data were analyzed with a statistical software package (SPSS 12.0 version). Paired *t*-tests and independent *t*-tests were used to examine within- and between-group effects. The significance level was set at *p* < .05. **Results:** Both the 60s and 70s groups significantly (*p* < .05) improved on the chair-stand test, arm-curl test, and chair sit-and-reach test after jazzercise. Only the 60s group showed significant (*p* < .05) improvements in the back-scratch test (right side), 6-min-walk test, and one-legged standing with closed eyes test. Values for the 8-foot up-and-go test and body composition were not changed with exercise in both groups. Changes in all variables were not statistically different between these groups. **Conclusions:** Jazzercise had positive impacts on functional fitness in elderly women. Particularly, it helps improve muscle strength and lower limb flexibility. We suggest that jazzercise can improve fitness of elderly women, regardless of age. However, more research is still needed using different targets or methods in the exercise program to demonstrate beneficial physical improvements in women in their 60s and 70s.

**Playgrounds for Older Adults: A Feasibility Study**

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**Background:** An active lifestyle is generally considered one of the most important factors for maintaining an independent lifestyle with aging. In The Netherlands, local communities often lack proper facilities for providing physical activity programs for seniors, and costs for these programs are high. The aim of this study was to examine the feasibility of using a public playground and playground equipment for an exercise program for older adults.

**Methods:** Thirteen community-dwelling older adults (mean age 72 years) living in the Feijenoord district of the city of Rotterdam followed a 10-week exercise program two times a week at a public playground. Exercises aimed to enhance balance, coordination, and flexibility and were supervised by a physiotherapist. Measurements included satisfaction with the exercise program and with the playground equipment, performance-based mobility and balance scores, and fear of falling. **Results:** Participants’ satisfaction with the use of playground equipment and with the exercise program was high (mean overall grade on a 10-point scale was 9.4). The high attendance (mean attendance rate was 92% of sessions) further demonstrated the high acceptance of the program and the use of playground. The participants improved their performance on the timed up-and-go test at the follow-up measurement by an average of 10%. The average score for fear of falling decreased from 3.3 (range 1–10) to 2.2 (range 1–6) on a 10-point scale, 10 being very much afraid and 1 being not afraid. **Conclusions:** The results demonstrate that the exercise program and use of the playground equipment are feasible and well tolerated by older participants. Exercise on the playground may enhance older adults’ mobility and decrease their fear of falling. The use of playgrounds offers a new and inexpensive way to provide a physical activity program for older adults. Playgrounds may fulfill a new social role and provide new opportunities to promote physical activity among older adults.
Poster Presentations

Epidemiology of Physical Activity and Aging

Functional Fitness in Frail Older Women

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Background: As a part of the reorganization of the public-care insurance system, the Japan Ministry of Health, Labor, and Welfare proposed a new classification, “frail older adults,” (FOA) in 2006. FOA is defined as ranked between nonfrail older adults (NFOA) and support- or care-level older adults (SCOA). These three classifications are determined through the original criteria using questionnaires and health check-ups for Japanese older adults age 65 years and over. However, the status of functional fitness remains unknown in FOA. Objective: The purpose of this study was to determine the characteristics of functional fitness for FOA and compare them with those for NFOA or SCOA. Methods: One hundred thirty-eight older Japanese women (75.4 ± 6.9 years) were assigned to the three categories (FOA, n = 44, 74.2 ± 6.9 years; NFOA, n = 60, 71.4 ± 4.6 years; SCOA, n = 34, 83.4 ± 6.5 years) depending on the classification criteria. All subjects completed the following functional fitness tests: grip strength, 5 chair sit-to-stands, one-leg balance, tandem walk, tandem stance, functional reach, sit-and-reach, alternate step, timed up-and-go, timed 5-m habitual walk, and carrying beans. An analysis of covariance (ANCOVA) with age acting as a covariate was used to test for differences in the mean of functional fitness among the three groups. Functional fitness score (FFS) was estimated by principal-components analysis. Results: Significant differences were observed among the three groups in all functional fitness tests except sit-and-reach. FOA was ranked between the NFOA and the SCOA in the following items: 5 chair sit-to-stands (FOA, 9.4 ± 2.9 s; NFOA, 6.3 ± 1.1 s; SCOA, 13.2 ± 4.0 s), tandem walk (13.6 ± 4.4 s, 9.8 ± 3.0 s, 20.6 ± 6.8 s), and alternate step (5.9 ± 1.7 s, 4.4 ± 0.6 s, 8.7 ± 3.5 s). Significant differences were also observed among the three groups in FFS (FOA, 0.0 ± 0.6; NFOA, 0.7 ± 0.4; SCOA –1.0 ± 0.7). Conclusions: These data suggest that the comprehensive status of functional fitness for frail older women was intermediate between NFOA and SCOA groups. Remarkable differences were observed among the three groups, especially in lower-extremity function.

Combined Effect of Physical Activity and Mobility Limitation on Falls and Injurious Falls in Older Women

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Objective: To study the association between physical activity, perceived mobility difficulty, and risk for falls and fall related injuries in older women. Methods: The data were drawn from the Finnish Twin Study on Aging. 434 women age 63–76 years at baseline were followed up for incidence of falls and injurious falls over 12 months with prospective monthly fall calendars. Perceived difficulty in 2-km walk and level of physical activity were assessed
with structured interview. According to these measurements, participants were divided into four groups: 1) Intact mobility and physically active (Mobile-Active), 2) Intact mobility and sedentary (Mobile-Sedentary), 3) Impaired mobility and physically active (Impaired-Active), and 4) Impaired mobility and sedentary (Impaired-Sedentary). Age-adjusted incidence rate ratios (IRR) for falls and injurious falls were computed with negative binomial regression.

**Results**: During the 12-month follow-up 221 participants experienced at least one fall. The total number of falls was 440, of which 195 were injurious. Compared with the Mobile-Active group, women in the Impaired-Active group had 6 times greater risk for falls (IRR 5.8, 95% CI 1.3–26.3, \( p = .02 \)). Compared with the Mobile-Active group, the risk for injurious falls was 5 times greater (IRR 4.7, 1.2–18.2, \( p = .03 \)) for those in the Impaired-Active group and 15 times greater (IRR 14.9, 2.3–96.3, \( p = .005 \)) for those in the Impaired-Sedentary group.

**Conclusion**: In older people with impaired mobility, physical activity may increase the risk for falls overall, but impaired mobility combined with sedentary lifestyle makes people more prone to injurious falls.

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**Longitudinal Changes in the Physical Fitness Levels of 80-Year-Old People: A 10-Year Follow-Up**

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**Background**: Little is known about age-related decline in physical fitness of 80-year-old individuals. The purpose of this study was to describe the longitudinal (10-yr) decline in physical fitness of 80-year-old people. **Methods**: In 1997, 607 (236 men and 371 women) Japanese individuals of 994 who were exactly 80 years old and resided in Iwate Prefecture of Japan underwent a physical fitness test including handgrip strength, one-leg standing time with eyes open, and stepping rate. The subjects were thereafter followed up every 5 years over the 10-year period from 1997 to 2007. A total of 68 subjects performed the physical fitness test every 5 years (including 25 men and 43 women) and therefore were investigated in 2007. Maximal handgrip strength was measured in each hand using a Smedley dynamometer. The best value in two trials for each hand was taken as the score for the test. One-leg standing time was measured with the eyes open. This time represented the number of seconds until the subject had to hop, until the raised foot was lowered to the floor, or until 2 min had elapsed. Stepping rate was measured using an industrial stepping-rate counter; while sitting, the subject was instructed to step with each leg as rapidly as possible for 10 s. The stepping rate for both legs was summed as the subject’s score. **Results**: The mean values for handgrip strength at 80, 85, and 90 years of age were 34.1 ± 4.1, 27.0 ± 8.8, 29.0 ± 5.8 kg for men and 22.1 ± 3.7, 18.0 ± 4.2, 18.1 ± 3.7 kg for women, respectively. During the 5-year follow-up period from 1997 to 2002, 2 women could not perform the one-leg standing test with their eyes open. During the 5-year follow-up period from 2002 to 2007, 14 women could not perform the one-leg standing test with their eyes open. The mean values for one-leg standing time with eyes open at 80, 85, and 90 years of age were 32.7 ± 29.6, 12.7 ± 10.4, 6.3 ± 5.3 s, respectively, for men. The mean values for the one-leg standing time with eyes open at 80, 85, and 90 years of age were 15.9 ± 24.2, 8.3 ± 9.3, 5.7 ± 7.0 s, respectively, for women who were able to perform this test three times. The mean values for the stepping rate
at 80, 85, and 90 years of age were 74.4 ± 10.9, 63.7 ± 18.9, 65.1 ± 13.7 times per 10 s for men and 62.6 ± 11.6, 42.8 ± 18.6, 51.9 ± 19.5 times per 10 s for women, respectively. All measurements regarding physical fitness were significantly higher for men than for women. **Conclusions**: No similar tendencies were observed in the age-related decline rate of the components of physical fitness over a 10-year period. For both sexes, one-leg standing time with eyes open clearly declined with age. On the other hand, handgrip and stepping rate declined more dramatically during the period from 80 to 85 than from 85 to 90 for both sexes. The findings of this study are thought to provide interesting data regarding the relationship between physical fitness and independent living for the elderly population.

**Relationship Between Peak Torque of the Ankle Plantar Flexors During Gait and Falls in Community-Dwelling Middle-Aged and Elderly**

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**Introduction**: Falls occur frequently during walking, and they often cause serious problems, particularly in the elderly. To prevent falls, determination of gait characteristics may give some useful information. During gait, ankle plantar-flexor torque plays an important functional role to propel and support the body. Few studies have assessed whether the magnitude of this torque is related to fall-risk factors. **Purpose**: The purpose of this study was to describe the relationship between peak torque of ankle plantar flexors during gait and falls in the community-dwelling middle-aged and elderly. **Methods**: The subjects of this study were Japanese men and women who participated in the third examination of the National Institute for Longevity Sciences-Longitudinal Study of Aging (NILS-LSA). The NILS-LSA was a comprehensive study including medical, physiological, nutritional, and psychological examination, which started in November 1997 in Japan. The third examination held from April 2002 to May 2004. The subjects were community-living adults age 40–84 years who comprised 1,170 males and 1,131 females. The subjects were asked to walk on a 10-m wooden walkway at a self-selected comfortable pace. To calculate peak torque of ankle plantar flexors during gait, 3-dimensional coordinates of body segments were obtained using an optoelectronic 6-camera system (Vicon370, Oxford Metrics) that recorded the 10 bony markers. Also, two force platforms (9286, Kistler) were embedded in the center of the walkway. The subjects were divided into two groups according to this peak torque at 59.8 Nm (the 20th percentile). Thus, the 20th percentile below group and the 20th percentile or above group were used for analysis. The history of falling during past year was determined according to self-administered questionnaires. **Results and Discussion**: Chi-square test revealed that the prevalence of the falls was higher in women (11.2%) than in men (8.8%; *p* < .01). The fallers were significantly older (61.4 ± 12.6 yrs) than the nonfallers (59.6 ± 11.5 yrs; *p* < .01) by Student’s *t* test. The peak torque of ankle plantar flexors during gait was significantly lower in the fallers (73.8 ± 20.2 Nm) than in the nonfallers (76.4 ± 19.1 Nm; *p* < .05). By a multivariate logistic regression, the risk of falls was significantly higher in the 20th percentile below group than in the 20th percentile or above group, even after being controlled for age, sex, height, weight, and walking velocity (odds ratio: 1.31, 95%CI: 1.03–1.66, *p* < .05). These results indicated that the fallers exhibited less peak torque of the ankle plantar flexors during gait, which might connect to less momentum of center of mass of gravity and less acceleration of leg swing in the preswing phase compared with the nonfallers. **Conclusion**: It is suspected that decrease in peak torque of ankle plantar flexors during walking leads to risk of falls in the community-dwelling middle-aged and elderly.
Standing Up From a Lying Position Is Associated With Risk of Long-Term Care Among Nondisabled Community-Dwelling Older Adults
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**Background:** Several cross-sectional and short-term follow-up studies have reported that physical function is associated with disability and long-term care. However, little information is available on the relationship between physical function and risk of long-term care with long follow-up studies in Japan. **Purpose:** The aim of the study was to examine the association between physical function and the risk of incident long-term care in community-dwelling nondisabled older people. **Methods:** The subjects in this study included 159 men and 316 women, age 60 and over, living independently in a community. These subjects were assessed during the years from 2000 to 2006. Eight physical fitness performance tests consisting of upper limb strength, whole-body locomotion, and change of posture were measured at baseline. In addition, self-reported questionnaires including exercise habits, health status, visits to hospital, and so on were filled out. Multivariate Cox proportional hazards regression was used to model the relationship between six physical fitness performance tests (hand grip, arm curl, stand-up from lying position, functional reach, walking around two cones in a figure 8, and chair stand) at baseline and incident long-term care during the 6-year follow-up period. **Results:** Twenty subjects (7 men and 13 women) started requiring long-term care during the 6-year follow-up period. At baseline, the eventual long-term care users were older and lower in physical fitness and had a greater frequency of going to hospital regularly than nondisabled subjects. However, no significant difference existed in exercise habituation and health-related quality of life between the two groups. In a proportional hazards model adjusted for age and sex, low scores in stand-up from a lying position predicted approximately twice the risk for eventually needing long-term care (hazard ratio = 1.81, 95% confidence interval = 1.28–2.55, <.001). **Conclusions:** Stand-up from a lying position at baseline was found to be associated with a greater risk of long-term care among nondisabled older Japanese during the 6-year follow-up. Further investigations are needed to describe the association between the influence of the condition of a disease and incident long-term care during follow-up.

Effects of the Vitamin D Receptor Genotype on the Association Between Muscle Strength and Bone Loss in Postmenopausal Japanese Women
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**Introduction:** Osteoporosis and related fractures are major public health problems in the elderly. It is well known that low bone-mineral density (BMD) is the most important determinant of osteoporosis. Recently, some studies have suggested that genetic factors regulate the response of BMD to lifestyle factors such as physical activity. However, little is known about the effect of gene polymorphism on the association between muscle function and bone loss in the community-dwelling population. **Purpose:** The purpose of the current study was to assess the interaction between single nucleotide polymorphisms (SNPs) of the
vitamin D receptor gene (VDR), muscle strength, and longitudinal changes in BMD among postmenopausal Japanese women. **Methods:** The data for the current study were derived from baseline, and data were collected for the subsequent three biennial follow-ups as part of the survey of the National Institute for Longevity Sciences-Longitudinal Study of Aging (NILS-LSA). The subjects consisted of 507 postmenopausal women (age 62.5 ± 8.2 years at baseline) who had completed the following examination and analysis. BMD was measured by a dual-energy X-ray absorptiometry (DXA; Hologic QDR-4500A). Measurement site was the right femoral neck (FN). The VDR SNPs (G/A) were genotyped using an automated fluorescent allele-specific DNA primer assay system (Toyobo Gene Analysis), and the polymorphisms were divided into two genotype groups (GG vs. GA/AA). Knee-extension strength was measured by an adjustable straight-back chair with the pelvis, knee, and ankle fixed at 90° (KES; Takei Co.). The interactive effect of VDR genotype and KES on BMD changes was investigated using a mixed-effect model analysis, which is a type of statistical analysis commonly used for repeated measurements, controlled for age, body-mass index (BMI), and age of last menses. Significant probability levels were less than .05. Statistical testing was performed using the Statistical Analysis System (SAS, release 9.1.). **Results:** The mean BMD at the FN was 0.660 g/cm² at baseline. The annual change in BMD was –0.007 g/cm²/year. Bone loss in the early postmenopausal years (<10 years since menopause) was observed to be greater than that in the later postmenopausal years. The result of analysis with the mixed-effect models indicated that there was a significant interaction between the VDR polymorphism and KES on BMD changes (p < .05). Bone loss at the low level of KES was greater than the higher levels of KES among carriers of the GA/AA polymorphism, whereas this difference was not observed for GG polymorphism. Estimated bone loss of carriers of GA/AA polymorphism at 20 kg, 24 kg, and 30 kg of KES (setting at age = 80 years, BMI = 22 and last menses age = 50 years) was about –0.266, –0.238 and –0.197 g/cm², respectively. As for GG polymorphism, estimated bone loss at all levels of KES was about –0.193 g/cm². **Conclusion:** The results suggested that strong knee-extension strength may contribute to preservation of further bone loss for the carriers of GA/AA polymorphism in postmenopausal Japanese women.

**Effects of Aging on Physical Symptoms of Postmenopausal Japanese Women**

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**Objective:** Around and after menopause, several indefinite symptoms, so-called climacteric symptoms, appear. These symptoms are influenced by many factors, including hormonal status, aging, and psychosocial conditions. But, these factors are complex and interrelated. To investigate the effects of aging, we reevaluated climacteric symptoms, especially physical symptoms of Japanese women. **Design and Methods:** Subjects were 388 postmenopausal Japanese women who visited our menopause clinic. All of the subjects had natural menopause. Data from 52 women in their 40s (mean age ± SD 47.3 ± 1.7 years, periods after menopause ± SD 2.4 ± 2.1 years), 138 women in the first half of their 50s (52.3 ± 1.3 years, 2.9 ± 2.4 years), 137 women in the second half of their 50s (56.8 ± 1.5 years, 6.0 ± 4.1 years), and 61 in their 60s (64.3 ± 4.1 years, 14.3 ± 7.0 years) were recorded. There was no significant difference in the period after menopause between the 52 women in their 40s and that of the 138 women in the first half of their 50s. Climacteric symptoms were objectively assessed at the first visit by use of the Keio Climacteric Questionnaire, which
grades the severity of 29 physical and 11 psychological symptoms. **Results:** In general, the prevalence of symptoms increased through the late half of the subjects’ 50s but decreased in their 60s. Among the 40 symptoms assessed by the Keio Climacteric Questionnaire, general fatigue was the most severe one for women in their 40s and 50s but not for women in their 60s. On the other hand, forgetfulness increased with age and was the most severe symptom among women in their 60s. Shoulder stiffness maintained a high severity score in all age groups. The prevalence of seven symptoms (hot flashes, sweating, joint pain, irritability, numbness, vaginal dryness, and dysphagia) was significantly higher in women in the first half of their 50s than those in their 40s. For women in their 60s, the prevalence of three of these symptoms (hot flashes, sweating, and irritability) decreased significantly, but that of other symptoms showed no significant change. From the first half of their 50s to the 60s, the prevalence of lumbago, loss of hair, and wrinkled skin significantly increased, while that of other symptoms was stable or decreased. **Conclusion:** Among climacteric symptoms of Japanese postmenopausal women, it is thought that aging more strongly influences joint pain, numbness, vaginal dryness, and dysphagia, which are all in the category of physical symptoms. As lumbago, loss of hair, and wrinkled skin, which are also physical symptoms, seemed to be more prevalent in older age groups, it is necessary to manage these symptoms in the early stages of menopause to help maintain patients’ quality of life.

**Characteristics of Accidental Falls Among Elderly People in a Rural Area of Japan**

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**Objective:** The purpose of this study was to investigate characteristics of accidental falls and related risk factors among elderly people in a rural area of Japan. **Participants:** Seventy elderly people age 65 and older (mean age 75.7, range 65–94) living in a rural area of Japan. **Measurements:** Physical examinations and questionnaires were used to identify the risk factors for falls between faller and nonfaller groups. Maximal grip strength, timed up-and-go test, Activity Balance Confidence (ABC) Scale, habitual exercise, farm work, chronic pain, assistive device use, the Tokyo Metropolitan Institute of Gerontology (TMIG) index of competence, and dizziness were assessed. Falls data and fall-related-injury data for the previous year were self-reported. The data were analyzed using the chi-square test, the t test, multiple logistic regression, and Pearson’s product–moment correlation coefficient. **Results:** Twenty-three participants (32.9%) experienced accidental falls during the previous year. Twelve participants (17.1%) suffered fall-related injuries (bruise or wounds, 6 persons; fracture, 6 persons). When participants were divided into two groups (fallers and nonfallers), chi-square tests revealed significant group differences for those over 75 years old (73.9%), the presence of chronic pain (87.0%), and assistive device use (43.5%; all p < .05). The prevalence of falls was significantly smaller in participants who had done farm work (39%) than in those who had not (p < .05). There were no differences in the ABC score, maximal grip strength, TUG, dizziness, habitual exercise, and TMIG index of competence between fallers and nonfallers. However, participants who suffered fractures had significantly lower ABC scores than those who had not. In conclusion, from multiple logistic-regression analyses, farm work (odds ratio [OR] = 0.1, 95% confidence interval [CI] :0.02–0.8, p < .05), the presence of chronic pain (OR: = 7.8, 95%CI: 1.2–52.0, p < .05), assistive device use (OR = 19.9, 95%CI: 2.1–187.0, p < .01), and lack of habitual exercise (OR = 8.0, 95%CI: 1.5–42.6, p < .05) emerged as influences and factors in fall. Furthermore, the ABC scores of farm workers were significantly higher than those of nonrural workers and significantly correlated with TMIG index of
competence \((r = .4, p < .05)\). **Discussion and Conclusions:** Fall incidence rate and injury rate were similar to previous study in urban area of Japan. However, what seemed to be specific to rural areas was that farm workers had fewer falls and higher self-efficacy. These findings have important implications for prevention of fractures in rural elders.

**Predictors of Cessation of Regular Leisure-time Physical Activity in Community-Dwelling Elderly People**

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**Background:** Maintaining regular physical activity is important for physical and mental health, providing benefits including protection against chronic disease. However, little is known about the causes of cessation of habitual physical activity in older people. **Objectives:** To identify predictors of cessation of regular physical activity in community-dwelling elderly people. **Methods:** 582 community-dwelling people aged 70 years and over who were living in Tokyo, Japan were surveyed regarding physical activity levels two years after completing an initial survey where they indicated they took part in physical activity at least five days a week. Baseline demographic, health, physical functioning and psychological status measures were used as predictors of exercise cessation. **Results:** At the two-year follow-up 192 subjects (33%) had ceased taking part in regular physical activity. In univariate analyses, women, smokers, those who reported a fear of falling, and those with a slower walking speed at baseline were significantly more likely to cease regular physical activity. Multiple logistic regression analysis identified three of these variables as significant and independent predictors of activity cessation: female gender (adjusted \(OR = 1.67–95\% CI = 1.13–2.47\)); smoking, (\(OR = 2.34–95\% CI = 1.33–4.13\)); and slow walking speed (\(OR = 1.79–95\% CI = 1.07–2.98\)). **Conclusions:** This population-based study identified that being female, smoking, and having slow walking speed were predictors for cessation of regular physical activity in community-dwelling elderly people. These results may help providers of community services to identify elderly people with high levels of risk and to discuss with them methods of intervention for continuance of regular physical activity.

**Yearlong Physical Activity and Metabolic Syndrome in Older Japanese Adults: Cross-Sectional Data From the Nakanojo Study**

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**Background:** Individuals showing a specific group of diagnostic markers (metabolic syndrome) have a several-fold increase in the risk of death from all causes and from certain specific cardiovascular diseases. The prevalence of metabolic syndrome is now a serious health issue for elderly Japanese, as in the senior citizens of many developed societies. The underlying mechanisms have not been entirely elucidated, but obesity and inadequate physical activity are crucial contributing factors. In the past 2 decades, the proportion of elderly Japanese with a body-mass index (BMI) >25 kg/m\(^2\) has risen progressively to the
current level of 31% in men and 30% in women. Regular moderate-intensity physical activity seems sufficient to reduce the risk of both obesity and metabolic syndrome in older people; such activity increases both insulin sensitivity and cardiovascular capacity while decreasing body mass and preventing an excessive accumulation of fat. However, the optimal pattern of preventive physical activity remains unclear, since most investigators have either used subjective questionnaires or have limited accelerometer or pedometer measurements to a single week, despite clear evidence of seasonal changes in activity patterns, particularly among the elderly. The present study thus examined relationships between metabolic risk factors and yearlong objective assessments of the amount and intensity of habitual physical activity in elderly adults. **Methods:** The subjects were 91 male and 129 female volunteers, aged 65–84 years. A pedometer/accelerometer measured the number of steps taken and a 2-level categorization of the intensity of physical activity on a 24-hr basis for an entire year. After inspection for inappropriate recording, 1-year averages were computed for daily step count and daily duration of exercise >3 metabolic equivalents (METs). Diagnoses of metabolic risk were based on a modification of criteria proposed by the NCEP-ATP III. Metabolic syndrome was diagnosed in participants who showed three or more of the following criteria: 1) a BMI >25 kg/m², 2) a fasting serum triglyceride concentration >1.65 mmol/L, 3) a fasting serum high-density lipoprotein cholesterol concentration <1.04 mmol/L for men or <1.30 mmol/L for women, 4) a systolic blood pressure >130 mmHg and/or a diastolic blood pressure >85 mmHg, and 5) a fasting plasma glucose >6.05 mmol/L and/or a hemoglobin A1c >5.5%. Criteria for categories 2–5 included values observed in individuals who were receiving medication. **Results:** Most individuals aged 65–74 years who took >10,000 steps/day and/or spent >30 min/day in activity >3 METs had <2 metabolic syndrome diagnostic markers, as did those aged 75–84 years with >8,000 steps/day and/or >20 min/day at >3 METs. Multivariate-adjusted logistic-regression analyses showed that the risk of metabolic syndrome was 4.3 (1.6–11.7) and 3.3 (1.3–8.8) times greater in the least active quartiles of subjects (those taking <4,700 steps/day and spending <9 min/day at >3 METs, respectively) relative to the most active quartiles (those taking >8,500 steps/day and spending >24 min/day at >3 METs, respectively). **Conclusions:** Relative to their sedentary peers, metabolic syndrome is less likely to be seen in elderly people taking >8,000–10,000 steps/day and reaching an intensity >3 METs for >20–30 min/day.
overall volume of effort are also likely to be important, although the optimal intensity for an older person remains a controversial issue. **Objective:** We thus determined associations between physical fitness and yearlong pedometer/accelerometer assessments of the quantity and quality of habitual physical activity in healthy older adults. **Methods:** Subjects were 76 male and 94 female Japanese aged 65–84 years. A pedometer/accelerometer was worn for 1 year, measuring the number of steps taken each day and a 2-level classification of the intensity of physical activity. At the end of the year, traditional laboratory techniques assessed selected aspects of physical fitness, including preferred and maximal walking speeds, peak handgrip force and knee extension torque, total body sway, and maximal functional reach. **Results:** After controlling for age and/or sex, lower-extremity function (walking speeds and knee extension torque) showed significant positive relationships with daily step count and daily duration of activity >3 metabolic equivalents (METs), especially in individuals ≥75 years of age. On the other hand, grip force and body sway were unrelated to either measure of habitual physical activity. Linear and exponential regressions showed positive associations between walking speeds and habitual physical activity up to the observed maxima of 14,000 steps/day and 60 min/day at an intensity >3 METs. However, when data were categorized into quartiles, walking speeds were not significantly greater in persons exceeding recommended minimum standards of habitual physical activity: counts of 7,000–8,000 steps/day and/or periods of 15–20 min/day at >3 METs. With a few exceptions, subjects meeting these criteria had walking speeds above the threshold predicting the subsequent development of functional dependence in initially nondisabled older adults. **Conclusion:** Our cross-sectional data suggest that to maintain fitness, elderly people should be encouraged to take at least 7,000–8,000 steps/day, and spend >15–20 min/day at >3 METs. Nevertheless, these findings merit confirmation by prospective studies.

**Physical Activity and Incidence of Urinary Incontinence in Community-Dwelling Middle-Aged and Elderly Women**

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**Introduction:** As the community ages, conditions affecting the quality of life and activity of older people become of increasing concern. Urinary incontinence (UI) is defined as any involuntary leakage of urine. More than a half of the middle-aged and elderly women have experienced UI in Japan. Although UI is not life threatening, it is a disease that causes personal distress and social handicaps and worsens quality of life. Some special pelvic floor muscle training has been recommended to protect against UI or to reduce its volume. However, it is somewhat troublesome to maintain special training for a long term. It might be easier to keep daily physical activity or physical fitness but little is known about whether they have an effect on the prevention of UI. **Purpose:** The purpose of the current study was to evaluate the effect of daily physical activity and physical fitness on the incidence of UI among community-dwelling middle-aged and elderly women. **Methods:** The data for the current study were derived from the second- and fourth-wave examination of the National Institute for Longevity Sciences-Longitudinal Study of Aging (NILS-LSA). Among 847 women aged 41–82 years who participated in both examinations, 414 (48.9%) had not experienced UI at the second-wave examination (baseline). After 4.2 years follow-up, at the fourth-wave examination, 79 (19.1%) suffered from newly onset UI. Leisure-time and on-the-job physical activity were assessed using a questionnaire at the baseline and follow-up examinations.
Gait velocities, step frequencies, and step lengths at comfortable and maximum gait were estimated in 10-m walking. As for physical fitness, muscle strength and power, such as grip strength, sit-up, knee-extension strength, and leg-extension power, were also measured at both examinations. The effects of physical activity or physical fitness on the prevention of UI were assessed by multivariate logistic-regression analyses controlled for age, body mass index, and parity, using SAS 9.1.3. Statistical significant probability levels were set to .05. **Results:** The women who did 2.5 METs or more leisure-time physical activity at both examinations showed lower risk of onset of UI compared with those who did not at both examinations (Odds ratio: 0.473, 95% confident interval: 0.251–0.892). Those who did 4.5 METs or more on-the-job physical activity at baseline, who walked with higher frequency in fast walking at baseline, who walked with higher frequency in comfortable walk at the follow-up examination, and who walked with higher frequency and higher velocity in fast walking at the follow-up examination also showed lower risk of onset of UI. On the other hand, none of muscle strength and powers at baseline and follow-up examinations showed significant relationship with the risk of incidence of UI. **Conclusion:** Physical activities, especially moderate leisure-time physical activity and walking with high frequency, may prevent onset of UI in middle-aged and elderly women.

**Do Physical Activity Level and Physical Functionality Account for Mobility Limitations in Older Adults?**

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**Background:** Physical activity is important for maintaining functional independence of older adults, especially for those with existing functional deficits. Mobility limitations (ML) such as difficulty walking and climbing steps are an intermediate state on a trajectory from health to physical disability. PA has frequently been cited as having a protective effect on ML indirectly through physical functioning in older adults. However, the effects of physical activity level (PAL) and physical functioning scores on ML are currently unknown. **Pose:** The objective of this study was to examine whether PAL and physical functioning influence ML in older adults. **Methods:** A cross-sectional analysis was conducted using 710 community-dwelling older adults with a mean age of 72.0 years (SD = 6.8, range = 60–93). PAL was determined from responses to a series of questions on the frequency and duration of leisure-time physical activity (walking, physical exercise, or other sport). Participants were classified as metabolic equivalent (MET) hours per week (3 tertiles: low, <3 MET-hr/wk; middle, 3–12 MET-hr/wk; high, >12 MET-hr/wk). Physical functioning was determined using a test battery that included one-legged stance, tandem stance, alternate step test, 5 chair sit-to-stands, functional reach, timed up-and-go, tandem walk, and usual gait speed. ML was identified via face-to-face interviews where the participants self-reported some difficulty in walking one quarter of a mile or climbing 10 steps without resting. Multiple logistic-regression analysis was used for statistical solution. **Results:** Approximately one third (n = 228, 32.1%) of the study sample reported ML. Prevalence of ML was higher in the low PAL tertile (49.9%) than in the high PAL tertile (15.6%). In the logistic model adjusted for age and gender, participants in the middle PAL tertile (odds ratio [OR], 0.42; 95% confidence interval [CI], 0.28–0.64) and in the high PAL tertile (OR, 0.24; 95% CI, 0.15–0.38) were significantly less likely to have ML than were participants in the low PAL tertile. In addition,
better physical functioning scores (one-legged stance, 5 chair sit-to-stands, functional reach, timed up-and-go, and usual gait speed) were significantly associated with decreased risk of ML ($p < .05$). **Conclusions:** Our data suggest that greater PAL is associated with reduction in risk of ML in older adults, including leisure-time physical activity of $\geq 3$ MET-h/wk. In addition, this study indicates that poor lower extremity function, walking ability, and balance are important risk factors in determining ML. **Key Words:** physical activity level, physical functionality, mobility limitations.

**Influence of Aging and Gender on Blood Velocity in the Human Common Carotid Artery, Accounted for by Body Size**

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**Objectives:** It has been postulated that arterial hemodynamic functions alter with aging. The present study was performed to investigate the level of blood velocities and its indices in the common carotid artery (CCA) as an influence of aging and gender and possible interactions between body size and its velocity indices. **Methods:** We collected blood velocity spectra from the left CCA, blood pressure from left left brachial artery, and electrocardiogram (ECG) from the chest using a developed synchronized measurement system. We have completely developed the real-time measurement system of blood velocity spectra in CCA with synchronized ECG and a blood pressure monitor. The device is constructed for portable use so it is capable of measuring during physical exercise. In the study, blood velocities are analyzed and characterized to 5 components of velocity waveforms: peak systolic (S1), second systolic (S2), incisura between systole and diastole (I), peak diastolic (D), and end-diastolic velocity wave (d). First, to assess the effect of gender on velocities and arterial hemodynamics, we selected 50 putatively healthy male ($n = 30$) and female ($n = 20$) volunteers, and second, to assess the effect of aging on velocity waveforms in the CCA, we selected 82 putatively healthy volunteers, varying in age between 21 and 67 years. We used Pearson’s correlation analysis to assess the effect of aging and the associations between arterial hemodynamics and velocities and used Student’s $t$ test to assess the significant difference of gender in the arterial functions. **Results:** Blood velocities in S1 and D decreased with aging ($r = -.711, p < .0001, r = -.521, p < .0001$, respectively). We have reported that the velocity indices of CCA have the potential to evaluate the effect of aging and habitual exercise. The reflection index (S2/S1-1) increased with age ($r = .797, p < .0001$). The vascular elastic recoil index (1-I/D) decreased with aging ($r = -.640, p < .0001$). The most pronounced systolic blood pressure is lower in young women than men ($p < .05$). Women had higher diastolic velocity components and second systolic velocity, but had lower systolic velocity compared with men ($p < .05$). Women had a significantly greater wave reflection, smaller vascular resistive, and lower vascular elastic recoil than men ($p < .05$), as measured from proposed velocity indices. Greater body weight is significantly associated with higher blood pressures ($p < .05$) and lower blood velocities ($p < .05$). Shorter height affected not only the increased velocity wave reflection index but also the decrease of peripheral vascular resistive index (RI) and arterial vascular elastic recoil index. Our results show that velocities in CCA continuously
decrease with aging; however, the decrease can be improved by regularly performed exercise as we reported before. **Conclusions:** The present findings indicate that aging and gender alter arterial hemodynamics in both velocity and pressure regulations. The gender difference in arterial hemodynamics in CCA velocity waveforms is largely accounted for by body height and weight. After taking into account all relevant factors, the assessment of aerobic fitness and vascular aging may be performed by using the criteria of peak systolic and peak diastolic velocity and its velocity indices.

**Usefulness of Color-Changeable Chewing Gum to Evaluate Masticatory Performance in Community-Dwelling Elderly Persons**

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**Aim:** The chewing ability of community-dwelling elderly persons is often evaluated with subjective questionnaires. However, an objective evaluation is necessary to determine actual masticatory ability so that any problems can be addressed. The purpose of this study was to determine the usefulness of a color-changeable chewing gum to evaluate masticatory performance in community-dwelling elderly persons. **Methods:** We analyzed the reliability of color-changeable chewing gum for assessment of masticatory performance in 13 individuals who were examined on two occasions with a 1-month interval. We also analyzed the validity of color-changeable chewing gum for assessment of masticatory performance by means of a five-part examination of 210 community-dwelling elderly persons. The five parts were as follows: a dental examination, determination of the number of residual teeth, evaluation of masticatory performance with the use of the color-changeable gum, measurement of maximum bite force, and a questionnaire in which participants were asked to assess their own chewing ability and habits. Color changes in the gum after chewing were measured with a Color-reader and quantified with use of the a* color space defined by the Commission Internationale de l’Eclairage. A higher a* value indicates a higher degree of mastication. **Results:** With respect to reliability, the coefficient of variation for the a* of the color-changeable chewing gum was 4%. With respect to validity, a* of the color-changeable chewing gum had significant positive correlation with the number of residual teeth and maximum bite force in both men and women. In addition, men and women who reported good chewing ability by questionnaire had significantly higher a* values. **Conclusion:** We found the use of color-changeable chewing gum to be a highly reliable and valid method of evaluating masticatory performance. Our results indicate that this method could be useful for monitoring masticatory performance in the community-dwelling elderly.

**Aging Effects on the Structure Underlying Balance Performance Tests**

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**Introduction:** Balance performance in the elderly is crucial to maintain independence in activities of daily living. Balance impairment results in the likelihood of elderly people falling during these activities. Many tests to assess balance performance have been developed, notably center of pressure (COP) during quiet standing for static balance, timed up-and-go (TUG), and walking speed for dynamic balance, and computerized dynamic posturography,
named the EquiTest (NeuroCom) for perturbed balance. However, few reports reveal the structure underlying these balance performance tests between young and older adults. Covariance structure analysis is a tool that is able to test statistically whether the factorial structure fits the data. Therefore, this study examined aging effects on the factorial structure of the balance performance tests. Methods: Subjects: The subjects were 60 healthy young women (young group) and 60 community-dwelling older women (older group). The mean age of young and older groups was 22.2 and 69.2 years, respectively. The subjects for this study completed all of the balance performance tests. Test Items: This study consisted of four balance performance tests: COP, TUG, 5-m walking speed, and the EquiTest. In the EquiTest, scores and latencies were measured by perturbing a moving platform and visual surroundings. Model Specification: As a preliminary step for analysis of factorial invariance, we assumed a 3-balance-factors model on the basis of face validity and the results of factorial analysis for young and older groups. The model was a second-order factor covariance structure model in which BALANCE was the second-order latent variable. Three components of BALANCE were assumed as first-order latent variables with measurement errors: STATIC, DYNAMIC, and PERTURBED. Each first-order variable was assumed to have loadings on BALANCE. Observed variables were area of COP with eyes open and closed and the scores of Condition 2 in the EquiTest for STATIC, preferred and maximum walking speeds and TUG for DYNAMIC, and latencies in the anterior and posterior perturbations of the platform in the EquiTest for PERTURBED. Results: As a result of the analysis, the goodness-of-fit indexes (GFI) for all data of the models were acceptable (GFI: young group = .931, older group = .923). The same factors in the factorial structure model of BALANCE were revealed for young and older groups. But the factor loading of first-order factors on the second-order factor (BALANCE) were different between groups; for the young group, PERTURBED was the highest factor loading on BALANCE (standardized solutions: STATIC = .21, DYNAMIC = .24, PERTURBED = .76). On the other hand, for the older group, STATIC was highest factor (standardized solutions: STATIC = .71, DYNAMIC = .28, PERTURBED = .43). Conclusion: This study showed the common factorial structure of balance abilities were static, dynamic, and perturbed balance performance. It was suggested that for young people the perturbed balance performances were highly correlated and explained by a single factor, while for older people it was static balance performance.

Physical Function Tests to Evaluate Two Different Physical Disability Levels in Korean Older Adults

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Previous studies have determined that physical function makes an important contribution to realizing health goals, and mobility-related disability is an important marker of health status among older people. The purpose of this study was to examine the validity of two different physical disability levels based on self-reported physical disability information using health-related variables and physical function tests as criteria. The study participants were a community-based sample of Korean adults aged 65 years or older. Older adults who participated in activities at community centers were approached by a research assistant asking for their consent to participate. These older adults were grouped
into two levels according to their physical disability status (able and disabled based on their self-reported measures on mobility, instrumental activities of daily living, activities of daily living domains, and health-related variables [body fat, number of comorbidities, and self-perceived health status]). The activities in the mobility domain included walking 1 km, climbing 10 stairs, and doing heavy housework. Based on their self-reported physical disability, participants were categorized into an able group (able in all three domains) and a disabled group (disabled in the mobility domain only and able in IADL and ADL). They also performed the following physical function tests in a random sequence: grip strength (kg), stepping test (times/30 s), chair stands (s/5 times), one-leg balance with eyes open (s), functional reach (cm), walking around two cones (s), timed up-and-go (s), 5-m usual gait speed (s), and body fat (%). Data were analyzed using the SPSS statistical package. The mean differences of age, health status-related variables (body fat, number of comorbidities), and physical function tests were examined by a MANOVA at a .05 level of statistical probability. The results of the MANOVA analysis indicated a significant group effect. The able group outperformed the disabled group in all physical function tests. The validity of physical disability levels as based on self-reports was supported, especially for the able and disabled groupings. The results suggest that community mobility function of older adults can be captured by performance tests and can be used to categorize older adults into different stages of physical functional decline.

Comparing Effects of Leisure-Time and Non-Leisure-Time Physical Activity in Predicting Mortality: 8-year Follow-Up in Taiwanese Elderly

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**Purpose:** To compare the effect of leisure time physical activity (LTPA) and non-leisure-time physical activity (NLTPA) on mortality in Taiwanese elderly. **Method:** We analyzed the mortality data from a cohort of 876 noninstitutionalized community-dwelling men and women aged 65 years or over who had participated in the 1996 Elderly Medication Survey in Tainan. At baseline, through face-to-face home interviews, we collected information on education level, living status, smoking habits, drinking habits, leisure time and non-leisure-time physical activity level, medical history, and activities of daily living, together with measured height and weight, using a standardized protocol. Cox proportional hazards analysis was applied. **Results:** In univariate analysis, subjects aged over 75 and with BMI less than 18.5 and those who had difficulty in activities of daily living, diabetes mellitus, stroke, lower LTPA, or lower non-LTPA had a higher risk of 8-year mortality. After adjusting for age, gender, level of education, current smoking, habitual drinking, living status, medical history, and activities of daily living, total mortality was higher among the sedentary subjects, either defined by lack of leisure time or non-leisure-time physical activity, with hazard ratios of 1.3 (95% CI:1.01–1.68) and 1.43(1.07–1.91), respectively. However, if both LTPA and non-LTPA were put into the model simultaneously, non-LTPA but not LTPA significantly predicted mortality. **Conclusion:** Non-LTPA had stronger predicting power than LTPA on the 8-year mortality in Taiwanese elderly. **Keywords:** leisure time physical activity, non-leisure-time physical activity, mortality
Psychometric Properties of a Questionnaire to Assess Exercise-Related Musculoskeletal Injuries in Older Adults

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There currently is no reliable or validated tool for the assessment of exercise-related injuries in older adults. The objective of present study was to develop and evaluate the psychometric properties of a questionnaire to measure exercise-related injury in older adults participating in supervised multimodal exercise programs. **Purpose:** To conduct test–retest reliability and assess the construct validity of the developed questionnaire. Our hypothesis for the construct validity component of the study was that self-reported exercise-related injury in the older adult population would be correlated with health-care-provider diagnosis and injury incidence report forms collected at the study site. **Methods:** A literature review of exercise-related injury questionnaires generated potential items and questions relevant to the topic. An expert panel reduced the list of items by a consensus process to a list deemed relevant for assessing exercise-related injuries in older adults, and pilot testing of the new questionnaire was conducted. Test–retest reliability of the self-administered written questionnaire was determined at two time points, one week apart, at the Canadian Centre for Activity and Aging, a community-based older adult exercise facility. One week was determined to be of sufficient duration whereby participants were unlikely to recall their previous responses and there was a low risk of additional injury occurrence. The questionnaire asked participants about exercise-related injuries incurred at the facility in the 12 months previous, where injury was defined as a self-reported muscle, tendon, bone, ligament, or joint injury. Items included the mechanism of injury, cause of the injury, anatomical site of the injury, and treatment sought. Covariables (age, sex, body mass index, fitness, and attendance records) were obtained from available facility databases. The minimum requirement for reliability was set at .80. The kappa coefficient was used to determine repeatability for categorical variables. To validate the data obtained from the questionnaire, participants who reported having an injury were asked to provide contact information for the health care provider who treated the injury. The sample size for the validity study included all participating older adults reporting an injury. A correlation of >.4 was chosen to assess the hypothesis that with respect to the questionnaire, self-reported exercise-related injury would be correlated with health care provider diagnosis. **Preliminary Results:** The questionnaire was administered to 110 community-dwelling older adults (45 males, mean age 75 ± 8 y; 65 females, mean age 71 ± 8 y). Of the 110 volunteers, 16% (n = 18) reported having an injury in the 12 months previous. Test–retest reliability ranged from .76 to 1.00, with all but one variable (type of injury, .76) having kappa coefficients greater than .80. The lower extremities were the most common site of exercise-related injury. Overexertion or strenuous movements were the most common cause of injury occurring during strength training exercises. The final reporting of this study will include results regarding the validation of the questionnaire. **Conclusions:** The present questionnaire assessing the 12-month recall in older adults is a reliable measure of exercise-related injuries in older adults.
How Many Days of Pedometer Use Reliably Predict the Annual Activity of the Elderly? The Nakanojo Study

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Purpose: The spontaneous physical activity of free-living humans is influenced by many factors, both endogenous and exogenous. Thus, knowing the extent of intraindividual variance is critical to appropriate data sampling, whether monitoring individual patterns of physical activity or exploring the determinants of physical activity. We have recently had the opportunity to collect detailed physical activity measurements on a substantial healthy elderly population over an entire year. We here apply the techniques of variance analysis and Fourier transformation to examine patterns of variability of daily step counts within the individual and within our test population; this has allowed us to make mathematical estimates of the number of days of sequenced, randomly timed and seasonally-timed observations needed to predict the annual habitual physical activity in healthy elderly people over a 365-day period.

Methods: Subjects were 37 males (aged 71 ± 4 years, height 1.57 ± 0.06 m, body mass 58 ± 9 kg) and 44 females (aged 71 ± 4 years, height 1.47 ± 0.06 m, body mass 51 ± 8 kg), healthy Japanese. All gave their written informed consent to participate in this institutionally approved study after the protocol, stresses, and possible risks had been fully described to them. A uniaxial accelerometer/pedometer was worn on the waistband throughout each 24-hr period for an entire year, accumulating information on the individual’s daily step count. A computer program randomly resequenced the original day-by-day data from each subject, thus giving information equivalent to the sampling of step counts on randomly selected days. The original day-by-day data from each subject were also regularly resequenced based on season and day of the week. Total variances for the original, randomly resequenced and regularly resequenced data were each separated into between-subjects and within-subject components. We then applied a modification of the classical Spearman-Brown calculation, estimating the intraclass reliability coefficient as the proportion of total variance attributable to between-subjects variance. Results: The step count spectrum for the original data showed peaks with periods of 2.3, 3.5, and 7.0 days and an aperiodic component that had a greater power at low frequencies (i.e., nonwhite noise). These characteristics were absent in randomly resequenced data. To ensure that 80% of total variance was attributable to between-subjects variance, 25 and 8 consecutive days of observation were needed in male and female subjects, respectively. To achieve 90% on this same measure of reliability, 105 and 37 consecutive days of observation were required. In contrast, 4 days of randomly timed observations yielded 80% reliability for both men and women, and 11 and 9 days gave 90% reliability in men and women, respectively. If sampling also took account of season and day of the week, the respective observation periods for men and women were reduced to 8 and 4 days (i.e., 2 and 1 consecutive days of sampling every 89 days) for 80%, and to 16 and 12 days (i.e., 4 and 3 consecutive days every 89 days) for 90% reliability. Conclusion: When estimating annual step counts, seasonal and/or random sampling of data allows collection of reliable data over substantially fewer days than would be needed for consecutive observations.
**Relationship Between Physical Function and Quality of Life in Community-Dwelling Korean Elderly**

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**Introduction:** Regular physical activity is considered one of the most effective methods of promoting quality of life (QoL) among older individuals. Functional independence is a primary contributor to quality of life and is heavily dependent on a person’s ability to carry out activities of daily living. **Purpose:** The purpose of this study was to evaluate the relationship between QoL and physical performance/fitness in older Koreans. **Methods:** A cross-sectional field survey of elderly Korean subjects was conducted. All data were collected in senior well-being centers in the participants’ home communities. The data collected included physical function, QoL measures, and demographic variables. The physical function indexes included 2 flexibility measures (BS—back scratch, CSR—chair sit and reach), 3 agility/balance measures (UG—timed up-and-go, SLB—single-leg balance with eyes closed, FR—functional reach), and 2 measures of muscle function (CS—chair stand, AC—arm curl). QoL was measured by the physical health scales (PF—Physical Functioning, BP—Bodily Pain, RP—Role Physical, GH—General Health) of the Medical Outcomes Survey Short Form-36 (SF-36). For all variables other than UG, higher scores are indicative of better physical performance or perceived QoL. **Results:** A total of 800 elderly subjects participated in the survey including 140 males (73.5 ± 5.7 years) and 660 females (74.2 ± 6.2 years). A number of physical performance measures were significantly correlated to physical health QoL parameters from the SF-36: CSR, UG, FR, AC, and CS were significantly (**p** < .05) related to all QOL measures, while BS was related to PF only, and SLB was correlated to PF and BP. **Conclusions:** From this preliminary study, it was concluded that a high level of physical performance was related to better quality of life among elderly Koreans. This suggests that the incorporation of regular physical activity that improves muscle function, balance/agility, and flexibility is effective tool for promoting physical health of elderly Koreans.

**Relation of Body Composition, Serum Lipid, Aerobic Capacity, and Lifestyles to Bone Mineral Density**

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The purpose of this study was to examine the relation of body composition, serum lipids, aerobic capacity, and lifestyles to bone mineral density of the lumbar and femur regions and to find the interrelationships among aerobic capacity, body composition, and bone mineral density in middle-aged men. The study subjects visited a health promotion center of one hospital located in Seoul. They were 40- to 64-year-old men, 60 with osteopenia and 182 with normal bone mineral density, who did not have any metabolic disease influencing bone mineral density. Triglyceride (TG), low-density lipoprotein (LDL), and alkaline phosphatase (ALP) were analyzed in venous blood. Body composition was measured by bioelectrical impedance analysis (BIA). Aerobic capacity was assessed as submaximal exercise capacity measured on a treadmill using the Bruce test protocol. The intake of energy and nutrients were analyzed in CAN-Pro 2.0 (computer-aided nutritional analysis 2.0 program). Lifestyle habits...
such as smoking and drinking were collected through questionnaire. Bone mineral density at the lumbar and femur regions was evaluated by DEXA (dual-energy X-ray absorptiometry). The data were analyzed using multiple linear regression analysis to evaluate the association of bone mineral density and each body composition, serum lipid, aerobic capacity, nutrient intake, and lifestyle factor. The results of the study can be summarized as follows. Multiple regression analysis demonstrated independent effects of body weight, muscle mass, and calcium intake on bone mineral density. Bone mineral density at the lumbar region was positively correlated with body weight, muscle mass, alkaline phosphatase (ALP), and calcium intake. In addition, bone mineral density at the femur region was positively correlated with body weight, muscle mass, and calcium intake. But bone mineral densities at the femur and lumbar regions were not significantly related to fat mass. In conclusion, the results of study showed that while body weight and muscle mass are positively associated with bone mineral density in middle-aged men, the other factors of body fat mass and serum lipids were not significantly correlated. Therefore, increased body muscle mass and intake of calcium seem to preserve bone mineral density and prevent osteoporosis and fracture in middle-aged men. **Keywords:** bone mineral density, body composition, aerobic capacity, middle-aged men.

**Approach to Exercise Adherence for Adults in the Community**
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**Background:** Recently, preventive medicine has attracted considerably more attention. Many people understand the importance of exercise or moderate physical activity for our own health maintenance, because it helps alleviate various sicknesses that influence our lifestyle. Many people participate in community-based exercise programs, and in Japan each municipality creates health policies and makes the plans for health promotion. We searched for the characteristics of the active populations who prefer to use these types of public facilities. **Purpose:** We investigated the typical characteristics of the users of exercise facilities in the community and searched for the best way to use such facilities and equipment. The factor of exercise adherence through life’s various stages was of interest, to obtain more knowledge about involving health promotion strategies. Thus the purpose of this study was to clarify the related factors of exercise adherence and barriers to exercise.  

**Methods:** We assessed people in 2005–2006 by using a questionnaire in northern Kyushu. The participants were 308 active persons (10–79 years old) who exercise in four public facilities, but we excluded 22-year-olds or less in the analysis of factors affecting exercise adherence. We used SPSS ver. 12.0 for statistical analyses. **Results:** The users of public exercise facilities can be divided into two separate groups. One is a group of independent exercisers and the other consists of active participants in the health class. Comparison between these two groups indicated that the average age of the independents was younger. The characteristics of the independent exercisers were that they had jobs, and the ratio of women was about 60%. On the other hand, in the health class group the program was held during the day, so many participants were housewives, and the ratio of women reached about 90%. In addition, when we examined more details, it was clear that the period of exercising had an influence ($p = .006$, CI: 1.03–1.21). Moreover, when we asked about barriers against exercise these were “There was no time to do exercise,” “There was no place,” and “There was no mind that they were not at ease with themselves.” **Discussion:** The users of public facilities had taken to exercising every day, being interested in their
own health. We confirmed that the participation rate of the women was high, because they think exercise is convenient for their lifestyle, and existing under the environment of being able to practice it. On the other hand, the ratio of men was low, so social background also has a great influence. We need to create an atmosphere in which many people can easily exercise to improve their quality of life. Conclusion: We concluded that exercise adherence was influenced by the time of doing exercise. It is related to whether exercise is joyful and meaningful in our lives. We need to develop an approach for an environmental setting where exercise is easily done.

Study of Changes in Respiratory Thorax Movement Accompanying Aging: Analysis With a 3-Axis Accelerometer

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Introduction: Thorax movement accompanying respiration has traditionally been analyzed by wrapping a tape measure around the thorax to measure circumferential changes (Respitrace), winding a magnetic coil around the thorax and converting circumferential changes into electric signals for measurement (respiratory inductive plethysmography), and analyzing movement based on images. However, none of these techniques is capable of analyzing the acceleration of a part of the body surface. Therefore, we directly measured thorax movement in three dimensions with a 3-axis accelerometer using a compact sensor and analyzed the characteristics of thorax movement accompanying respiration as reported here. Subject: Subjects included 22 healthy individuals aged from 19 to 26 years (M ± SD: 20.5 ± 1.5 years; Group A) and 10 healthy individuals aged from 55 to 95 years (77.5 ± 10.5 years; Group B). Method: During deep breathing in an upright position, a 3-axis accelerometer (MVP-A3–04bc, Microstone Inc., Nagano Japan) was used to measure thorax movement on the sagittal plane at the intersection between the front edge of the axilla and the body surface. Measurements were collected for the following three levels: the axilla (upper level), the ensisternum (medium level), and the 10th rib (lower level). The acceleration measured on each horizontal level in three dimensions was compared between individuals in Group A and Group B. The significant level was below 5%. Result: Group A showed significant positive correlations between x-axis (thorax perimeter tangential direction) mean acceleration and y-axis (craniocaudal direction) mean acceleration and between y-axis mean acceleration and z-axis (body inward-outward direction) mean acceleration on the medium level and between x-axis mean acceleration and z-axis mean acceleration and between y-axis mean acceleration and z-axis mean acceleration on the lower level. Group B showed significant positive correlations between x-axis mean acceleration and y-axis mean acceleration, between y-axis mean acceleration and z-axis mean acceleration, and between y-axis mean acceleration and z-axis mean acceleration on the upper and lower levels and between y-axis mean acceleration and z-axis mean acceleration on the upper and lower levels. Conclusion: The young group (Group A) showed significant positive correlations between mean acceleration for only some directions at some positions. However, the old group (Group B) showed significant positive correlations between acceleration and many directions at several positions, primarily on the upper and lower levels. These findings indicate that aging changes respiratory thorax movement to three-dimensional unified movement.
Selection of Tests to Evaluate the Ability Required for Activities of Daily Living in Community-Dwelling Older Adults

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We all wish to grow old healthily. However, in recent years the number of people who need care has increased rapidly in Japan. It has become important to improve and maintain health status and physical fitness by means of daily physical activities and exercise in older adults. Therefore it is necessary to develop individualized types of training, along with the promotion of easy to administer physical fitness tests that can differentiate between older adults. **Purpose:** The aim of the current study was to establish the potential usefulness of easy to administer physical fitness tests for evaluating ability required for activities of daily living in community-dwelling older adults. **Methods:** The subjects were 562 community-dwelling older adults (163 men and 399 women, age = 67.3 ± 5.2 yrs) who could move freely without any walking devices, aged 60–86 years. The following nine-item test encompassing activities of daily living was used: grip strength, 30-s chair stand test, tandem, one leg with eyes open, functional reach test, timed up-and-go, sit-and-reach, 10-m maximal walking time, and maximal step. These items were selected from a viewpoint of the following: the test–retest reliability of each item, the ease of the instrumentation, the utility in regard to economy and safety, and items that have been used for evaluation of older adults to date. Factor analysis with normal varimax criterion was applied to the data. **Results:** As a result of test exclusiveness there was not a correlation with age. From the items that were extracted by factor analysis, the following tests were selected: grip strength, 30-s chair stand test, one leg with eyes open, functional reach test, timed up-and-go, sit-and-reach, 10-m maximal walking time, and maximal step in older men; one leg with eyes open, timed up-and-go, sit-and-reach, and 10-m maximal walking time in older women; grip strength, one leg with eyes open, timed up-and-go, 10-m maximal walking time, and maximal step in older adults. **Conclusions:** The results of this study suggested that five-item tests (grip strength, one leg with eyes open, timed up-and-go, 10-m maximal walking time, and maximal step) could evaluate ability required for activities of daily living in community-dwelling older adults. These tests would be valuable because of simplicity, economy, safety, and a possible self-measurement option.

Physical Activity of Older Adults in Japan

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**Objective:** To investigate physical activity in daily life by gender and age groups among Japanese older adults. **Method:** Six hundred community-dwelling adults, aged between 55 and 75 years, were recruited from 10 prefectures in middle and southern Japan. Subjects were interviewed when they attended community centers or undertook health checks at hospitals and clinics during 2006. Information on habitual physical activity was obtained using the International Physical Activity Questionnaire (IPAQ). Total physical activity level was computed by summing the walking and moderate and vigorous metabolic equivalent tasks (MET) in min/week scores. **Results:** Of the 575 eligible participants (355 men and
220 women) available for analysis, 458 (80%) participated in physical activities on a weekly basis. The mean total physical activity level was similar (p = .836) between men (1,805 MET min/week) and women (1,695 MET min/week). However, physical activity levels were found to be different between age groups (p = .007), with those aged 55–59 years (1,131 MET min/week) below the government-recommended level of 60 min of physical activity daily or 1,380 MET min/week. **Conclusion:** The 55–59 age group should be targeted for physical activity promotion. Moreover, physical activity guidelines should be developed specifically for Japanese older adults, especially for those over 65 years of age.

**Prevalence of Physical Exercise and Its Factors Among the Elderly in Khon Kaen Municipality, Khon Kaen Thailand**

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**Rationale:** Physical exercise is important for maintaining health and lowering the risk of disease in older adults. Since the promotion of elder health is important, we undertook to assess the proportion of elderly doing physical exercise and the associated factors for enhancing health among the elderly in the city. **Methods:** A cross-sectional, descriptive study was conducted, using systematic sampling in one community of Khon Kaen Municipality. A structured questionnaire was used to collect the information from 380 elders between July and September 2007. **Results:** The response rate was 98.1%. The mean age of the respondents was 69.2 (SD 7.74). The proportion of males was 39.0% vs. 61.0% females. Most of the respondents (80.4%) had completed primary school. The prevalence of elderly who do physical exercise was 25.7% (95% CI 21.33–30.57), and the multiple logistic regression indicated that companionship (adjusted OR 1.25, 95%CI 1.08–1.84) and health status (adjusted OR 1.11, 95%CI 1.05–1.87) were significantly related to physical activities. **Conclusions:** Only 25.7% (95% CI 21.33–30.57) of municipal elders were doing physical exercise. To promote more exercise among the elderly, more understanding of this group’s perspectives and needs is required.

**A Path Analysis Model of Health-Related Quality of Life Among the Elderly**

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**Purpose:** The aim of this study was to examine the structure of health-related quality of life (HRQoL) among the elderly. **Methods:** The subjects were 309 older adults aged 60 years or more (66 male, 243 female) in senior well-being centers and nursing homes in Seoul, Korea. HRQoL was assessed by Medical Outcomes Survey Short Form-36 (SF-36), which includes physical (PQoL) and mental (MQoL) component summaries. Functional fitness was estimated with the Senior Fitness Test Manual by Rikli and Jones. Activities daily of living (ADL) was assessed by Barthel index and the Lawton and Brody questionnaire. Path analysis models (LISREL 8) were used to examine the structure of HRQoL. **Results:** The explanatory power of the path analysis model was 32% for physical QoL and 16% for mental QoL. Physical QoL was positively influenced by lower leg strength (.238), ADL (.390), education (.082), and economic status (.016). Mental QOL was positively influenced by economic status (.277), dynamic balance (.181), ADL (.131), and physical QoL (.283). **Conclusion:** The path analysis model suggests that physical fitness and ADL have an important impact on HRQoL among older people.
Physical Activity and Balance Ability in Taiwanese Older Adults: A Preliminary Report

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Background. It is known that physical activity is associated with physical and mental health, functional capacity, and risk of falling in older adults. Such knowledge is mostly gained from research focusing on Western populations. Information specifically regarding Asian populations is scarce. However, due to differences in cultures, lifestyles, and environments, it is unclear if Asian populations show similar traits to their Western counterparts. The purpose of this study was to investigate physical activity, in association with balance ability, in Taiwanese older adults.

Methods. Sixty-five older adults who lived in southern Taiwan participated in the study. Structured questionnaires were used to obtain anthropometric information, history of falling in the past year, and physical activity (standing and walking time, exercise) in the past week. Health status was measured using the Short Form 12 Health Survey. Balance-related functional tests, including voluntary sway range, one leg stance time (max 30 s), and timed up-and-go, were used to represent balance performance. The modified Fall Efficacy Scale was used to assess activity-related fear of falling. Nonparametric or parametric analyses of correlation and between-group comparisons was used as appropriate.

Results. For the 65 subjects, the average age was 72.1 (SD = 5.6) years, and there were 34 females. Forty-eight of the 65 older adults reported exercising regularly, with walking as the primary type of exercise (42 out of 48 subjects). For those who did not exercise regularly, there were significantly more females (n = 14, p = .008) than males, while gender effect was nonsignificant for those who did. A total of 16 subjects reported to have fallen in the past year, with all but four reporting exercising regularly. The number of fallers, age, balance performance, and fear of falling did not differ significantly between those with and without regular exercise (p = .088). There was also no significant correlation between the daily standing and walking time on all balance-related measures. However, significant but low positive correlation (r = .28) was found between daily walking time and mental health.

Discussion and Conclusion. The study showed that the primary type of physical activity for Taiwanese older adults was walking, similar to what has been reported in the literature. What was unexpected is that greater physical activity was not related to better balance performance or less fear of falling. It is probable that other aspects of physical activity, such as intensity, frequency, which were not investigated in this study, could be of greater significance. What is more, it is equally possible that other factors such as physical activity in young and middle age or environment also contributed to the lack of association. Future studies with a broader scope of investigation and greater sample sizes are needed to better examine the issue.

Relationship Between Physical Fitness and Body Mass Index in Korean Older Women

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Introduction: Several studies have suggested that increased body mass index (BMI) is positively associated with mortality, disability, and problems in physical functioning. Older adults have an age-related increase in BMI and decline in physical function. Purpose: The purpose of this study was to investigate the relationship between selected physical fitness variables and BMI in older Korean women.

Methods: The subjects were 827 independently
living women over 60 years of age from 4 senior well-being centers. Based on percentile rank of BMI, subjects were categorized into three groups: (1) low BMI (18.5–22.9 kg/m²), (2) middle BMI (23–24.9 kg/m²), and (3) high BMI (25–30 kg/m²). Physical fitness was evaluated by using the following measurements: flexibility (BS—back scratch, SR—sit and reach), agility/balance (UG—timed up-and-go, SLO—single leg balance with eyes opened, FR—functional reach), and muscle function (CS—chair stand, GS—grip strength, AC—arm curl). ANOVA was used to assess the differences between three groups and physical fitness variables. **Results:** There were no differences between the three groups in BS, SR, UG, SLO, FR, and CS. Compared with the group with middle and high BMI, the group with low BMI were significantly lower in upper muscle function measured by using the GS and AC tests (*p* < .001). **Conclusions:** The results suggest that subjects categorized in low or high BMI were mostly lower in physical fitness variables than those of middle BMI. Weight gain and loss in older women may be linked to diminished ability to carry out activities of daily living.

**The Educational Support Program in Elementary School by the Elderly**

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The purpose of this study was to clarify the educational support program in elementary school given by older adult volunteers and its influence on their health status. This program was based on Experience Corps in Baltimore. The program served students in grades 1–3 during the school day, and two volunteers were assigned to a classroom. The volunteers attended homeroom and played with students during rest breaks in the school day. They also worked at the direction of the teacher to support student literacy, physical education, arts and crafts, etc. The subjects were six seniors (age 66.8 ± 5.8) and 64 students (age 7.4 ± 0.6) who lived in Himeji, Japan. We selected subjects for control groups including 62 community-dwelling persons aged 65 years or over who lived in the same district and 112 students (age 7.3 ± 0.7) who lived in a neighboring district. We carried out a baseline survey in the beginning of February 2007, and the follow-up surveys were done for senior volunteers and students in January 2008. We questioned several items such as motivation, benefits, and difficulties of this program by using a group interview method for seniors. A questionnaire for the students included health status, mental and emotional support from family, and school life and its rules. Through engaging in the educational support program in elementary school for a year, mental satisfaction and social networks were clearly promoted in senior volunteers. Health status test scores also increased in students.

**Chronic Diseases and Aging**

**An Innovative At-Home Walking Exercise Program for Patients With Chronic Obstructive Pulmonary Disease**

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**Objective:** Information and communication technologies have recently found their way into several very beneficial in-home health-care-based applications. Of particular focus has been the benefit that new wireless technologies offer in-home health-care patients. This project is
designed to help patients with chronic obstructive pulmonary disease (COPD) manage their daily home-based health-related activities using an ordinary mobile phone. It encourages the COPD patient to perform daily walking exercises at home and, thus, lessen COPD symptoms.

**Design:** This system consists of two modules. One is the personalized and scalable music tempo that the patient walks/exercises to. It works in accordance with the COPD patient’s personal clinical record and provides the patient with an adjustable music tempo to exercise to via walking. **Measurements:** Patients who join the study are required to take a shuttle-walking test during their first visit to the clinic. The system uses the test results to calculate the data set and generate an appropriate walking speed music tempo. That tempo is then forwarded to the patient’s mobile phone. In the past 3 months, more than 30 patients have signed up for the program. **Results:** According to the clinical study report, more than 85% of the patients are “satisfied” with the program. Many reported that the at-home walking exercise program made them want to exercise more and that it made them feel energized. In addition, the study shows that the patients’ COPD symptoms stayed in check even though they cannot be cured. **Conclusion:** The study successfully demonstrates that technology can improve the health of COPD patients. Unfortunately, due to the many various models of mobile phones and system limitations, it is not possible for the program to work with all models of mobile phones. As a result, 15% of the patients in the study had difficulty operating their mobile phones to the point that they had to discontinue participation in this study.

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**Glomerular Filtration Rate May Be Associated With Physical Function in Community-Dwelling Japanese Frail Elderly**

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**Background:** The risk of falling increases with aging. Falls are associated with loss of independence, deterioration of quality of life, and increased mortality. Vitamin D deficiency and/or low D-hormone is associated with a decrease of muscle strength, decreased balance, and loss of functional mobility. Impaired renal function with aging is detrimental for the conversion of calcidiol to calcitriol (D-hormone), and D-hormone analog has been shown to decrease the risk of falls. **Objective:** To examine whether glomerular filtration rate (GFR, ml/min/1.73-m² surface area) is associated with physical function in 113 community-dwelling frail elderly enrolled in a class for nursing care prevention (76.7 ± 5.9 yr). **Methods:** A cross-sectional study was conducted in a town (latitude 36° north) from June to September in 2006 and 2007 and November to February in 2006. An interview was conducted based on a questionnaire including score of functional capacity of ADL, experiences of fall, stumbling during the past year, walking ability, and the frequency of going outside of the home. The serum levels of 25(OH)D, intact parathyroid hormone (iPTH), 1,25-dihydroxyvitamin D (1,25(OH)2D), and creatinine were measured. The following physical tests were measured: timed up-and-go, a 5-m walk, functional reach, one-legged stance, tandem stance, 5 chair sit-to-stands, tandem walk, and alternate step-test. GFR was calculated using the modification of diet in renal disease (MDRD) formula. Participants were divided into 2 groups according to GFR <60 and GFR >60. Stumbling, functional capacity, being housebound, and physical function were compared between groups with GFR <60 and GFR >60. Multiple linear regression analysis was used for statistical solution. **Results:** The rate of participants with GFR <60 was 30.1%, and they were significantly older than those with GFR >60. GFR was
associated with iPTH ($p < .1$), iPTH significantly correlated with $25(\text{OH})\text{D}$ ($p < .05$), and $25(\text{OH})\text{D}$ significantly correlated with $1,25(\text{OH})\text{D}$. The prevalence of being housebound in the group with GFR $<60$ was significantly higher than in the group with GFR $<60$. The rate of $25(\text{OH})\text{D} <50$ nmol/L was not different between the group with GFR $<60$ and the group with GFR $>60$. On the other hand, the rate of $1,25(\text{OH})\text{D} <41$ pg/ml (lowest quartile) in the group with GFR $<60$ was significantly higher than that in the group with GFR $>60$. Three-meter tandem walk for balance in the group with GFR $<60$ was significantly slower than the group with GFR $>60$. Functional reach in the group with GFR $<60$ was also shorter than in the group with GFR $>60$. Tandem walk, 5 chair sit-to-stands, and alternate step-test were significantly affected by GFR by multiple liner regression analysis ($\beta$: $-0.32$, $-0.32$, $-0.30$, respectively).

**Conclusions:** Our data suggest that GFR is highly associated with walking ability and muscle strength.

**Yearlong Physical Activity and Sarcopenia in Older Adults: The Nakanojo Study**

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**Purpose:** Physical inactivity and aging are associated with a progressive loss of skeletal muscle mass (sarcopenia). However, the optimal patterns of habitual physical activity for conserving muscle mass remain unclear, since investigators have used either subjective physical activity questionnaires or accelerometer or pedometer measurements limited to a single week, despite clear evidence of both the unreliability of activity questionnaires and seasonal changes in activity patterns. We thus determined associations between skeletal muscle mass and the quantity and quality of habitual physical activity in an elderly population.

**Methods:** Subjects were 175 free-living Japanese aged 65–84 years (78 men, 97 women). Criteria of recruitment were willingness to participate, attendance at an annual medical examination, and the absence of chronic conditions that could limit physical activity. Subjects gave their written informed consent to this institutionally approved study after the protocol, stresses, and possible risks had been fully explained to them. They wore continuously for an entire year a pedometer/accelerometer that recorded the number of steps taken and the intensity of physical activity. At the end of the year, a whole-body dual X-ray absorptiometry (DXA) scan assessed each participant’s regional skeletal muscle mass. We defined sarcopenia (classes I + II) as a value of muscle mass/height$^2$ more than 1 SD below the mean for corresponding young healthy Japanese reference populations.

**Results:** The respective prevalences of arm, leg, and appendicular sarcopenia were 21%, 23%, and 23% in men and 24%, 27%, and 26% in women. Skeletal muscle mass scores were associated with yearly average scores for daily physical activity, the relationships being closer for the legs than the arms, and for duration of activity $>3$ metabolic equivalents (METs) than for step count. The data were significantly described by linear and exponential regression models; in both sexes appendicular muscle mass increased progressively with increasing daily physical activity, up to the observed maximum values of approximately 14,000 steps/day and 60 min/day at an intensity $>3$ METs. However, when data were categorized into quartiles of physical activity, the appendicular muscle mass was not significantly greater in persons who exceeded commonly recommended minimum standards of habitual physical activity.
(counts of 8,000 and 7,000 steps/day and durations >3 METs of 20 and 15 min/day in men and women, respectively). All participants who met such criteria (with the exception of a few men) had an appendicular muscle mass above the threshold for a clinical diagnosis of sarcopenia. Multivariate-adjusted logistic regression analyses predicted that both men and women who engaged in <4,400–5,300 steps/day and <15–16 min/day of moderate-intensity physical activity were, respectively, 2.0–2.7 and 2.0–4.6 times more likely to show sarcopenia than those engaging in >7,800–9,000 steps/day and >23–26 min/day of activity >3 METs.

**Conclusion:** Our data suggest that to maintain skeletal muscle mass, older adults should be encouraged to take at least 7,000–8,000 steps/day and spend at least 15–20 min/day at an exercise intensity >3 METs. Nevertheless, randomized controlled studies are needed to establish the cause-and-effect nature of the relationships that we describe.

**Effects of an Exercise Program on Postural Stability in Parkinson’s Disease**

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**Background and Objective:** Postural instability is a major clinical problem in the course of Parkinson’s disease (PD), but there is no proven method to enhance postural stability. To find the effect of a chronic exercise program on postural stability, PD patients in an exercise program were assessed by computerized posturography and compared with those without regular exercise.

**Method:** Eighteen PD patients (7 men and 11 women, age 65.2 ± 8.8 years, Hoehn and Yahr stage 2.5–3.0) who had been participated in an exercise program were recruited to the exercise group. Exercise programs consisted of tai chi, dancing, walking, and elastic band exercise, 3 times/week for over 12 months. Fourteen gender- and age-matched PD patients (5 men and 9 women, age 62.9 ± 8.0 years) without regular exercise were the control group. There was no difference in demographic and clinical characteristics between the two groups. All the patients measured sensory and voluntary motor control of balance by computerized posturography. Statistical analysis was done with Mann-Whitney’s U test and Spearman’s correlation test. P values of less than .05 were accepted as significant.

**Results:** The exercise group showed better performance in reaction time and directional control of stability compared with the control group. Interestingly, when these patients were divided into akinetic-rigid-dominant patients and tremor-dominant patients, the former were better than the latter in these performances in both the exercise and the control group. There were no differences in sensory organization tests and rhythmic weight shift tests between the two groups. Overall, age was correlated with dysfunction of sensory organization (r > .5), and performance of akinetic-rigid-dominant patients did not differ from those of tremor-dominant patients.

**Conclusion:** We found that PD patients in a long-term exercise program showed better performance in postural stability compared with those without regular exercise, especially in akinetic-rigid-dominant patients.
The Aging Effect on the Ratio of Total Cholesterol to High Density Lipoprotein between National Rugby Players and Untrained Males

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Introduction: The best indicator for predicting the development of atherosclerotic and coronary heart disease (CHD) is not only the simple levels of total cholesterol (TC) and low-density lipoprotein (LDL-C). The National Cholesterol Education Program (NCEP) has verified that the ratio of TC:HDL-C is extremely useful in estimating heart disease risk. Heredity, being a male, and aging have been listed as unchangeable risk factors for CHD by American Heart Association (AHA). Exercise on the other hand can be preventive, and rugby is one of the strongest sports of all. Therefore, it is valuable to detect the aging effects in the stocky males who play this popular sport. Purpose: Our interest was to detect and compare ratios of TC:HDL-C between national rugby players and untrained persons of various ages. Methods: Forty-five national rugby players and 97 male sedentary persons were our subjects; they were divided into four different age groups: 21–30 yrs, 31–40 yrs, 41–50 yrs, and over 51 yrs. Cholesterol was tested by the CHOD-PAP method, and HDL-C was quantified by the phosphotungstic acid- MgCl₂ precipitation method. ANOVA, least significant difference (L.S.D.), and t test were used to check the different levels between different groups and different ages. Results: Despite living conditions, the ratio of TC:HDL-C of 4.086 in the sample of national rugby players over 51 yrs of age is very different (p < .01) from the other age groups of players and the untrained group of the same age (3.717). In the groups of 21–30 yrs to 41–50 yrs, values for rugby players were less than those of untrained groups. Thus, it is different inversely in the over-51-yrs group (p < .01). Conclusion: Depending on L.S.D. and t test, the aging effect on the ratio of TC:HDL-C in national rugby players is very significant. Indeed, this ratio for the over-51-yrs group reached the dangerous range according to the NCEP classification (>3.0). Keywords: aging, coronary heart disease, untrained risk factor, ratio of TC:HDL-C

Gait Characteristics During Walking on Known Tripping Floor Surfaces in Older Japanese Stroke Patients

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Background: The risk of falling induced by tripping while walking is much higher in stroke patients than in healthy older adults. The number of falls in stroke patients especially increases after discharge from the hospital, as they have to live in their homes, which frequently have high-risk floor surfaces such as carpet and tatami. However, their gait training in rehabilitation is commonly conducted on indoor surfaces in the hospital. Purpose: To investigate gait characteristics during walking on known tripping floor surfaces in Japanese stroke patients. Methods: Eleven hemiplegic patients (age 68.1 ± 6.4 years) who were at home and could walk independently in daily life and 10 healthy older adults (age 66.4 ± 3.3 years) were
recruited. The following kinematic parameters were measured while subjects walked on three floor surfaces (carpet, tatami, and parquetry): (1) the vertical displacement of toe markers from floor surface (toe clearance) and (2) the angular displacements and velocities of the hip, knee, and ankle. **Results:** The group of stroke patients had significantly lower toe clearance in the paretic lower limb than that in the group of healthy older adults in the first swing phase (about 0–20% swing phase) on all floor surfaces. Furthermore, there were significant differences in the angular displacements and velocities of the hip, knee, and ankle between the group of stroke patients and the group of healthy older adults. In the first swing phase, the group of stroke patients had significantly smaller knee flexion of the paretic lower limb than the group of healthy older adults on all the floor surface. However, there were no differences among the three floor surfaces in any kinematic parameters. **Conclusions:** These results suggest that Japanese stroke patients have the gait characteristics that induce tripping, which include lower toe clearance in the paretic lower limb during the first swing phase. And these gait characteristics are associated with the smaller knee flexion in the paretic lower limb. To reduce their trip incidence, improvement of the knee flexion on the paretic side during the first swing phase is needed, especially during walking on known tripping floor surfaces.

**Physical Activity Levels and Their Relationship With Consumption of Medication Among the Elderly Population of Florianopolis, SC, Brazil**

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In the Brazilian population the number of elderly people is growing faster than any other age group, and it is of note that the consumption of medications by this population is increasing. This study was designed to investigate the physical activity levels of the elderly residents of Florianopolis, SC, Brazil, and their relationship with consumption of medications. This was a cross-sectional, descriptive, epidemiological study. Florianopolis has a population of approximately 450,000 inhabitants, 9.1% of whom are more than 60 years old. The data collection instruments employed were the International Physical Activity Questionnaire (IPAQ) and specific questions on the consumption of medications from the Brazil Old Age Schedule questionnaire (BOAS). A total of 875 elderly people were interviewed, comprising 437 men and 438 women, all over 60, with a mean age of 71 years (SD ± 7.6). Subjects were defined as more active if the sum of their physical activities performed at work, as transport, and in the form of domestic and leisure activities included at least 150 min per week of moderate and/or vigorous activities. The statistical analysis employed the chi-square test to compare responses to the questions on consumption of medications and physical activity levels. The results showed that just 27% of the elderly subjects were not taking any kind of medication, that there was no difference between the sexes in terms of activity, that the men who did not take medication were more active (18.5%), and that there was no difference among the women in terms of physical activity levels. Multiple-pharmaceutical consumption (more than 3 different medications) was observed in 14% of the whole sample, and in 8.2% these were more active people. There was no significant association between the total level of physical activity and consumption of medications (χ² = .054 p = .30). Consumption of medications was greater among more active subjects. It might be inferred from this that the more active elderly people take more care over their health and seek medical services.
more often. Even though this study has not demonstrated a relationship between the level of physical activity and consumption of medications, it appears that being more active is linked with generally caring about health.

**Autonomic Nervous System Activity and Aging in Mental Disorders**

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**Objective:** Several reports suggested that people with mental disorders have increased risks of coronary heart disease and sudden cardiac death. These risks may be associated with altered neural regulation in the cardiovascular systems. The activities of the autonomic nervous system (ANS), which modulates a human’s internal environment, decrease with aging in the healthy adult. However, in people with mental disorders, the change in ANS activities with aging remains unknown. The present study was designed to examine whether heart rate variability, which is considered an indicator of ANS activity, is altered with aging in subjects with mental disorders. **Methods:** One hundred thirty-three subjects with mental disorders and 94 healthy subjects participated in the current study. The ANS activities were measured during a resting condition by means of heart rate variability (HRV) power spectral analysis. In general, power spectral analysis of HRV has shown at least two distinct regains of periodicity in electrocardiogram R-R intervals. The high-frequency component (<0.15 Hz) is a major contributor to reflecting parasympathetic nervous system (PNS) activity, and the low-frequency component (<0.15 Hz) is dually mediated by the sympathetic nervous system (SNS) and PNS activities. In addition, the Global Assessment Scale (GAF) was used for mental disorder subjects to evaluate social adjustment prior. The mental disorders and healthy groups were classified into five groups according to their age: 20s, 30s, 40s, 50s, and over 60. The indexes of the spectral powers were logarithmically transformed for statistical analyses. **Results:** Significant interactions of age and subject groups were found in HR, TP, LF, and HF in the two-way ANOVA. In the healthy group, HR was not significantly different, while TP ($p < .01$), LF ($p < .01$), and HF ($p < .01$) were significantly decreased with aging. On the contrary, in the mental disorders group, HR was significantly lower ($p < .05$) in the older subjects compared with the younger subjects, while ANS activities showed no significant difference in any age groups. The GAF scores were lower (that is, low social adjustment ability) in the young subjects compared with the old subjects (20s, 23.0 ± 2.8; 30s, 27.0 ± 7.0; 40s, 29.2 ± 7.9; 50s, 33.0 ± 7.4; and over 60, 33.0 ± 11.1, $M \pm SD$). **Conclusions:** Our findings indicate that younger mental disorder groups may have reduced sympathovagal activity and lower GAF scores. Although causes and consequences remain to be elucidated, our findings suggest the possibility that such autonomic depression could be a crucial risk factor in undermining the health and, ultimately, the quality of life of mentally disordered patients.
Health Problems of the Elderly in a Rural Community in Southwestern Nigeria

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Objective: The study was to determine the common chronic health problems of the elderly in Igbo-ora, a rural community in western Nigeria. It also aimed to describe the pattern of chronic diseases and determine the psychosocial problems of the elderly.

Methods: It was a community-based cross-sectional study. Households in a cluster of three randomly selected blocks were visited. Information on the sociodemographic characteristics, health problems of the elderly, living conditions, and perception of their health needs was obtained from 279 elderly respondents aged between 60 and 100 years using an interviewer-administered questionnaire. Data were analyzed using SPSS version 11.

Results: The mean age of respondents was 69.52 (± 7.46) years. Most (89.2%) were in the age group 60–69 years while 10.4% were older than 79 years. One hundred twenty-eight (45.9%) of the respondents were males, and females were 151 (54.1%). Two hundred thirty-five (84.8%) of the respondents had no formal education, and 108 (47%) of the respondents were of the high socioeconomic class. The major health problems of the respondents included eye defects (91%), musculoskeletal disorders (58.1%), hypertension (24.3%), sleep disorder (24%), and dementia (15.8%). Respondents who were older than 69 years were more likely to have features of dementia (p = .031), Parkinson’s disease (p = .032), and urogenital problems (p = .005). However, respondents who were 69 years or less were more likely to have features of hypertension (p = .037). Males were more likely to have of urogenital problems (p = .009) and low back pain (p = .035). Females however were more likely to have hypertension (p = .022). Low socioeconomic status was associated with eye defects (p = .021) and urogenital problems (p = .005). Respondents with good perception of their health needs were likely to have formal education (79.4%, p = .000) and were likely to report symptoms suggestive of dementia (21.9%, p = .015). Of the respondents who had musculoskeletal problems, 124 (44.8%), 83 (30.2%), and 38 (13.9%) had joint pains, joint stiffness, and joint swelling, respectively. However, only 24 (9.1%) of the respondents were use walking sticks and most (60%) of them used them for musculoskeletal related problems. Respondents who were likely to have joint stiffness were males (p = .016), of low socioeconomic class (p = .043), and had suffered a stroke (p = .009). Respondents still had had joint pains (p = .000), joint stiffness (p = .000), dementia (p = .015), and low back pain (p = .012) despite having a good perception of what is required to stay healthy.

Discussion: Chronic diseases in the elderly are common, especially those affecting the visual, cardiovascular, and musculoskeletal systems. Females in this study were more likely to have hypertension while males were more likely to have urogenital problems. In this study, musculoskeletal problems, low socioeconomic status, and stroke disorder were significantly associated with limitation of physical activity. Respondents’ good perception of their health needs was associated with better identification of their health problems. This did not however prevent the development of disease.

Conclusion: Programs to improve the health conditions of the elderly should go beyond health education on the requirements for a healthy life and should include the materials needed to achieve it.
The Efficacy of Electroacupuncture at the Pudendal Nerve for Chronic Low Back and Lower Limb Symptoms of Older Adults

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Introduction: Acupuncture stimulation at the pudendal nerve has been applied to alleviate symptoms of neurogenic bladder dysfunction and chronic pelvic pain syndrome. We have found through our clinical experience that some patients with neurogenic bladder dysfunction who have applied electroacupuncture at the pudendal nerve reported improvement of their low back or lower limb symptoms. To clarify the clinical effect of electroacupuncture at the pudendal nerve, we studied the efficacy of electroacupuncture at the pudendal nerve in patients (lumbar spinal canal stenosis) for whom general conservative treatment (NSAIDs, hot packs, massage, etc.) was ineffective. Methods: The subjects were 11 patients (mean age 71.3 ± 7.6) with lumbar and lower limb symptoms that were not relieved by conventional conservative treatment for 2 months. The point for acupuncture stimulation to the pudendal nerve is located in the gluteal region (at a point 50–60% of the distance along a straight line from the posterior superior iliac spine to the lower inner edge of the ischial tuberosity). Two acupuncture needles were inserted in this region. These two needles were used as electrodes for low-frequency electroacupuncture treatment. A total of eight times (once a week), stimulation was performed at the pudendal nerve, on the same side of the lumbar and lower limb symptoms. Assessment of low back pain, lower limb pain, and lower limb dysesthesia was performed using a visual analog scale (VAS). Continuous walking distance was verified with reports by the patients themselves. Results: The VAS values for low back pain changed from 52.5 ± 15.1 mm (M ± SD) to 47.1 ± 13.8 mm, for lower limb pain from 63.3 ± 7.2 mm to 40.6 ± 12.3 mm, for lower limb dysesthesia from 64.1 ± 10.9 mm to 46.3 ± 17.1 mm, and for continuous walking distance from 103.5 ± 40.7 m to 250.5 ± 123.3 m. As a result of electroacupuncture stimulation of the pudendal nerve, improvement was seen in low back pain in 2 of 11 cases, in lower limb pain in 8 of 11 cases, and in lower limb dysesthesia in 6 of 11 cases, while continuous walking distance improved in 4 of 7 cases. Discussion: These results indicate that electroacupuncture of the pudendal nerve is an effective treatment for lumbar and lower limb symptoms due to spinal canal stenosis. Since this method was effective with cases that did not respond to conventional conservative treatment (NSAIDs, hot packs, massage, etc.), we presume that it is more effective than conventional conservative treatment. As electroacupuncture at the pudendal nerve can be performed using acupuncture needles, it enables a nonsurgical, percutaneous approach, which is very simple and a safe method of treatment. However, there may be a possibility that the patient will experience unpleasant sensation in the pudendal area during stimulation. For this reason, we propose that this method be applied secondary to acupuncture stimulation of the lumbar and lower limb muscles (general acupuncture treatment). A possible mechanism underlying the effect of electroacupuncture is that electrical stimulation at the pudendal nerve improves circulation to the cauda equine and/or sciatic nerve.
Physical Fitness and Activity in Sarcopenic Community-Dwelling Elderly in Taiwan

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Background and Purpose: Sarcopenia is the loss of muscle mass and is associated with declined muscular function with aging. Several studies have reported that sarcopenia significantly and independently determined self-reported functional impairment and disability in the elderly; however, little addressed their physical fitness or physical activity. Such information can be very important in developing health promotion programs for community-dwelling elders. The objective of this study was to compare the physical fitness and physical activity among community-dwelling elderly with sarcopenia, borderline sarcopenia, and normal skeletal muscle mass in Taiwan. Methods: This study was a cross-sectional investigation. Two hundred seventy-five community dwellers above 65 years of age (148 men and 127 women) participated in this investigation. Skeletal muscle mass was estimated from bioelectric impedance analysis measurements. Sarcopenia was defined as their skeletal muscle mass index (SMI = SM/height^2) less than 2 standard deviations (SD) below the mean for young healthy reference values and borderline sarcopenia as SMI within -1 to -2 SD of young adult values, while those SMI <1 SD below the mean of young healthy adults were considered to have normal skeletal muscle mass. Physical fitness tests included measurements of body composition (percent body fat, waist circumference), grip strength of the dominant hand, and cardiopulmonary fitness assessed by a 3-min stepping test. Physical activity habits were also queried. Elders who participated in physical activities 30 min a day and more than 3 days a week were considered regular exercisers. Data were analyzed using the Statistical Package for Social Sciences (SPSS for Windows release 11.0). One-way ANOVA with post hoc and chi-square tests were used to examine the differences of measured variables among three groups. A p value less than .05 was considered statistically significance. Results: Compared with the normal control group, elders with sarcopenia had significantly lower values of grip strength in men (23.3 ± 8.9 kg vs. 27.7 ± 8.0 kg, p < .05) and in women (13.5 ± 5.5 kg vs. 17.3 ± 6.7 kg, p < .05), as well as physical efficiency index derived from the 3-stepping test in men (56.3 ± 16.3 vs. 66.7 ± 11.7, p < .05) and in women (46.9 ± 13.6 vs. 66.3 ± 15.2, p < .05). Waist circumferences of sarcopenic elders were significantly lower than their normal control counterparts in men (86.1 ± 8.7 cm vs.92.4 ± 8.1 cm) and in women (81.3 ± 9.5 cm vs.91.2 ± 9.9 cm). No significant differences in physical fitness tests were found between borderline sarcopenia elders and elders in the control group. The percentage of regular exercisers in the control group was the highest among the three groups, 57%, 57%, and 66% in men and 45%, 46%, and 67% in women, respectively. Conclusion: Elders with sarcopenia had lower muscular strength, cardiopulmonary fitness, and percentage of regular exercisers than those without sarcopenia. Physical activity or exercise interventions are indicated to prevent muscle loss and maintain good cardiopulmonary fitness for elders with sarcopenia.
Effect of Endurance Exercise Training After the Emergence of Hypertension on Nitrative Stress on the Hearts of Spontaneously Hypertensive Rats

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**Introduction:** We investigated the effects of exercise training after the emergence of hypertension on nitrative stress and protein levels and activities of nitrative stress-related enzymes in the hearts of spontaneously hypertensive rats (SHR). **Materials and Methods:** We examined the hearts of 25-week-old (wk) SHR that performed either 10 wk of voluntary exercise training (Ex) or remained intact (Cont). We also analyzed 5 wk and 15 wk SHR to determine basal alterations of nitrative stress and the enzymes. 25 wk Ex SHR exercised by voluntarily running in a wheel-cage for 10 weeks from the age of 15 weeks. Systolic blood pressure was measured using the tail-cuff method. At the end of the breeding or training period, rats were anesthetized and hearts were collected. We measured the level of nitrotyrosine by time-resolved fluoroimmunoassay method, the amount of manganese-containing (Mn-) and copper/zinc-containing (Cu, Zn-) SOD, and endothelial nitric oxide synthase (eNOS) in the heart by the Western blotting method. Furthermore Mn- and Cu, Zn-SOD, and total NOS activity were measured by spectrophotometry. **Results:** Systolic blood pressure of the SHR was elevated at 15 wk and remained high until 25 wk Cont SHR. The exercise did not affect blood pressure. Although no significant increase of 3-nitrotyrosine (3-NT) contents was observed in 100,000 g precipitate fractions (P2) of heart homogenate of 15-wk-old SHR, a significant increase of 3-NT contents was observed in that of 25-wk Cont SHR. This increase of 3-NT contents was significantly attenuated in that of 25-wk Ex SHR. The same alterations of 3-NT levels were observed by immunohistochemical analysis using specific antibody for 3-NT. Protein levels of eNOS in the membrane fractions were reduced in 15-wk and 25-wk Cont SHR compared with those of 5-wk SHR, but not affected by Ex. This evidence was supported by the measurements of total NOS activity in the same fractions. Protein levels of Cu, Zn-SOD were reduced to a greater degree in 25-wk Ex and Cont SHR than in those of 5-wk and 15-wk SHR, but no significant effect was observed by Ex. The same results were obtained on measurements of Cu, Zn-SOD activity. On the other hand, protein levels of Mn-SOD increased significantly in 15-wk SHR compared with that of 5-wk SHR. Although no significant difference in Mn-SOD levels was observed between 25-wk Cont SHR and 15-wk SHR, statistically significant increases of Mn-SOD levels and activity were observed in 25-wk Ex SHR compared with those of 25-wk Cont SHR. This evidence accounts for the significant attenuation of 3-NT formation in P2 fraction of 25-wk Ex SHR. **Conclusion:** We conclude that 10 weeks of exercise training after the emergence of hypertension could reduce nitrative stress in the organelle fractions of the heart as a result of the increase of Mn-SOD.
Age- and Gender-Specific BMI Associated With the Lowest Mortality

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Background: Body mass index (BMI) has often been used as the de facto body weight standard or the criterion of the optimal body weight in health management scenes because it is a reasonable and useful method for assessing body size or body fat. The World Health Organization (WHO) has proposed cut-off points for BMI to designate an underweight (BMI below 18.5 kg/m\(^2\)), normal (18.5–24.9 kg/m\(^2\)), overweight (25.0–29.9 kg/m\(^2\)), obese (30.0–39.9 kg/m\(^2\)), or very obese (above 40.0 kg/m\(^2\)) body condition. These criteria are widely used throughout the world. However, some studies have indicated that race can influence the relationship between anthropometric variables and health risks. A WHO expert consultation emphasized that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMIs lower than the existing WHO cut-off point for overweight (above 25 kg/m\(^2\)). Therefore, in 2004, a WHO expert consultation proposed a new cut-off point (23 kg/m\(^2\)) for the Asian population based on the results of a meta-analysis.

On the other hand, several studies indicated that the optimal BMI tended to be higher for the elderly compared with the young or middle-aged populations. They suggested that the weights recommended when age is not considered as a variable are too liberal for young adults and too restrictive for elderly Caucasians. Objective: The primary purposes of our study were to establish age- and gender-specific BMIs in terms of lowest mortality (risk nadir BMIs) for the Japanese population and to then compare those to 1) BMIs for Caucasians as determined by similar studies and to 2) the official BMI guidelines.

Research Methods and Procedures: A total of 32,060 men and 61,916 women aged 40–79 years underwent health checkups in Ibaraki Prefecture, Japan, in 1993 and were followed through 2003. To determine the age- and gender-specific risk nadir BMIs, coefficients and the lowest point from a quadratic model with transformed BMI were calculated by a Cox proportional hazard model. This included the quadratic term of 1/BMI and adjusted values (age, alcohol intake, and smoking status). Results: For both age and both gender categories, the relationship between all-cause mortality risk and BMI categories are illustrated as U-shaped curves. In men, the risk nadir BMIs for 40–59 years and 60–79 years were 23.4 kg/m\(^2\) and 25.3 kg/m\(^2\), respectively. Similarly, in women, the BMIs were 21.6 kg/m\(^2\) and 23.4 kg/m\(^2\), respectively.

Discussion: The risk nadir BMI for the 60–79 year group was higher than for the 40–59 year group among the general Japanese population, which was similar to the study for Caucasians, and the age-dependent risk nadir BMI differed from the official guideline criteria. Our findings underscore the importance of weight control following appropriate indicators of body weight according to age.
Coronary Heart Disease Risk Status May Not Account for Physical Functioning but Is Associated With Health-Related QoL in Older Adults

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**Background:** The impact of coronary heart disease (CHD) on physical functioning (PF) of older adults is of growing interest because of an increasing number of people that survive the disease. Health-related quality of life (HRQoL) measurement has documented profoundly negative effects of cardiac disease. However, there have been few studies on the association between prediction of CHD risk, PF, and HRQoL in older persons. **Purpose:** The objective of this study was to examine whether CHD risk status has an association with PF and HRQoL in older adults. **Methods:** A cross-sectional analysis was conducted using 110 Japanese older adults (32 men, 78 women with a mean age of 67.9 years; SD = 3.99, range = 60–74) having no past history of CHD and no medical comorbidities. CHD risk status was determined by using a method previously reported in the Framingham Heart Study (Wilson et al., *Circulation*, 1998) using risk factor categorization. In brief, sex-specific prediction equations were formulated to CHD risk status according to age, diabetes, smoking, blood pressure categories, and total cholesterol and LDL cholesterol categories. PF was evaluated using 30-s arm curl, one-legged stance, tandem stance, alternate step test, 5 chair sit-to-stands, functional reach, timed up-and-go, and usual gait speed. HRQoL was assessed by the 36-item Short-Form Health Survey (SF-36). PF score was developed by summing scores for the 8 PF tests. This score was obtained by a principal component analysis that yielded one primary factor. **Results:** Based on CHD risk status using basic risk factors, 40.9% of participants had a predicted CHD risk \( \geq 10\% \). Prevalence of CHD risk was significantly higher among men (78.1%) as compared with women (25.6%). There was no relationship between CHD risk status and PF score \((r = .10; p = .28)\). Some statistical analysis revealed significant correlation \((p < .05)\) between CHD risk status and bodily pain \((r = -.20)\), general health \((r = -.26)\), vitality \((r = -.19)\), and role emotion \((r = -.20)\) of HRQoL subscale domains. However, there was no statistically significant correlation between physical function, role physical, social function, and mental health with other HRQoL subscale-related items. **Conclusions:** Our data suggest that there is no significant relationship between CHD risk status and PF score in this study group. However, CHD risk status may influence, to some extent, to HRQoL of older Japanese adults. **Keywords:** coronary heart disease; physical functioning; health-related quality of life

Which Anthropometric Measure Correlates Well With Metabolic Syndrome and Functional Performance Well in Older Adults?

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**Purpose:** Waist circumference was found to be highly correlated with metabolic syndrome in the middle-aged. In the study, we would like to test if it is still true for older adults and, also, if the related measures correlated with some important functional performance measures. **Methods:** In this cross-sectional study, the anthropometric measures (BMI,
waist circumference [WC], hip circumference [HC], waist/hip ratio [W/H], waist/height ratio [W/Ht], and hip/height ratio [H/Ht]) were recorded and the functional performance tests (30-s sit-to-stand [STS], timed up-and-go [TUG], and 6-min walk test [6WT]) were performed by 256 community-dwelling older adults (mean age = 76.20 ± 6.10; 110 males, mean age = 77.22 ± 6.45; 146 females, mean age = 75.40 ± 5.71). In addition, their chronic disease statuses were recorded. Descriptive statistics of the variables of the elderly were analyzed. The anthropometric measure differences between the metabolic and nonmetabolic syndrome groups of both genders were tested by independent t test. The relationships of the anthropometric measures and the functional performance tests were analyzed by partial correlation coefficient adjusted by age and stratified by gender. **Results:** In the male older adults, only the BMI (24.04 ± 3.41 vs. 22.64 ± 2.95, t = −2.15, p < .05), and in the females, the BMI (25.26 ± 3.69 vs. 23.33 ± 3.24, t = −2.92, p < .005), WC (88.14 ± 9.10 vs. 84.60 ± 8.60, t = −2.38, p < .05), HC (100.10 ± 8.04 vs. 97.26 ± 6.65, t = −2.31, p < .05), and H/Ht (0.65 vs. 0.63, t = −2.33, p < .05) showed significant difference between metabolic and nonmetabolic syndrome groups. In the male older adults, only the 30-s STS was significantly correlated with WC (r = −.21, p < .05). In the females, the 30-s STS was significantly correlated with WC (r = −.29, p < .001), HC (r = −.18, p < .05), W/H (r = −.25, p < .01), W/Ht (r = −.21, p < .05); the TUG with W/H (r = .20, p < .05); and the 6WT with WC (r = −.23, p < .05), W/H (r = −.30, p < .001), and W/Ht (r = −.21, p < .05). **Conclusion:** For the elderly, BMI may be a better indicator than the WC for predicting metabolic syndrome in both genders. The older females with smaller waist circumferences and waist:hip ratios may show better scores in functional performance.

**Age Difference in Traditional Coronary Risk Factors in Male Subjects With Angiographically Patent Coronary Artery**

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**Purpose:** To find out if there is an age difference in traditional coronary risk factors in male subjects with angiographically patent coronary artery (PCA). **Methods:** Male subjects who underwent angiography for the reason of valve or congenital preoperation examination or suspicion of coronary artery disease were enrolled. According to the AHA classification, the result of PCA was divided into a normal group (NG) if there was completely no stenosis and a nonsignificant stenosis group (NSG) if the stenosis level is below 50%. Subjects were divided into a middle-aged group (<65 years old) and an old-age group (≥65 years old). Using whether stenosis existed as the dependent variable, logistic analysis modeling was performed to provide odds ratios (OR) and 95% confidence intervals (CI) dependent variables related to stenosis in the different age groups. **Results:** There were 674 subjects (age: 60.4 ± 12.3) that enrolled to the current study, including 588 in the NG group and 86 in the NSG group. There were 283 subjects in old-age group, including 237 in the NG group and the 46 in NSG group. OR for coronary stenosis are 3.02 (95%CI 1.45–6.28) and 1.01 (95%CI 1.01–1.02) for subjects in the old-age group with diabetes and high total cholesterol, respectively. Likewise, OR for coronary stenosis are 2.03 (95%CI 1.01–4.12) and 1.01 (95%CI 1.01–1.02) for subjects in middle-age group with diabetes and hypertriglyceridemia, respectively. **Conclusion:** In male subjects with PCA, diabetes is the common risk factor for NSG coronary stenosis in both middle-aged and old-age groups.
Gender Difference in Traditional Coronary Risk Factors in Old Subjects With Angiographically Patent Coronary Artery

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Purpose: To find out if there is a gender difference in traditional coronary risk factors in older adults with patent coronary artery (PCA). Methods: Subjects above 65 years old who underwent angiography for the reason of valve or congenital preoperation examination or suspicion of coronary artery disease were included. According to the AHA classification, the outcome of PCA was divided into a normal group (NG) if there is completely no stenosis and a nonsignificant stenosis group (NSG) if the stenosis level is below 50%. Subjects were divided into a male group and a female group. Using whether stenosis existed as the dependent variable, logistic analysis modeling was performed to provide odds ratios (OR) and 95% confidence intervals (CI) dependent variables related to stenosis in the different gender groups. Results: There were 530 subjects (age: 71.8 ± 5.1) that enrolled to the current study, including 449 in the NG group and 81 in the NSG group. There were 247 female subjects, including 212 in the NG group and 35 in the NSG group. The OR for coronary stenosis was 2.97 (95% CI 1.35–6.53) for female subjects with diabetes. Likewise, OR for coronary stenosis were 2.92 (95% CI 1.39–6.11) and 1.01(95% CI 1.01–1.02) for male subjects with diabetes and hypercholesterolemia, respectively. Conclusion: In old subjects with PCA, diabetes is the common risk factor for NSG coronary stenosis in both women and men.

The Effect of Moxibustion Treatment for Pain Caused by Hallux Valgus During Activities

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Objective: Hallix valgus is a painful disorder manifested by lateral deviation of the first toe and medial deviation of the first metatarsal. The pain due to hallux valgus not only interferes with sporting activity but also prevents the performance of daily activities. Although there is a large amount of literature on acupuncture and/or moxibustion treatment, there still is no literature on acupuncture and moxibustion for hallux valgus. Reducing the pain due to hallux valgus leads to improvement in ability. The purpose of this study was to examine the effect of moxibustion treatment for reduced pain due to hallux valgus during activity. Methods: The subjects were five young females with pain due to hallux valgus; the average age was 22 years. All study subjects had chronic pain for at least 6 months with a mild hallux valgus deformity (hallux valgus angle of less than 20°). Indirect moxibustion treatment was carried out on the region of maximum pain to relieve pain. The treatment was performed once a day for 2 weeks, for a total of 14 times. Evaluation used the number of side steps performed in a limited time period and a numerical rating scale for pain (ten-point method: zero = absolutely no pain, 10 = maximum pain experienced with that episode) during the side-step trial. Side-steps measurement conformed to the standard method that is used in the
surveys on physical strength. We also evaluated the learning effect resulting from repeated measurements. **Results:** After moxibustion treatment, pain improvement was observed in all subjects during the side-step trial. Complete relief from pain was found in some cases. In addition, the number of side steps increased. Repeated measurements before and after moxibustion indicated that there was no significant learning effect in the first, second, or third measurement. Moreover, no aggravation was reported. **Discussion and Conclusion:** We found that the pain due to hallux valgus is mitigated by moxibustion over a fixed period, while athletic ability is also improved. It seems likely that the effect is the result of activation of the pain inhibitory system and/or improvement in the regional circulation. We suggest that the pain due to hallux valgus during activity is controllable with moxibustion treatment, which may result also in improvement in athletic ability, though its sustainability is unclear. In conclusion, indirect moxibustion is potentially effective in the therapy of pain due to hallux valgus.

**Type, Duration, and Effect of Physical Exercise on Chronic Health Diseases Among Urban Elderly in Khon Kaen Province, Thailand**

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**Rationale:** Physical exercise has been accepted as a health promoting behavior among the elderly. The type and duration of physical exercise affects health. We aimed to explore the type, duration, and effect of physical exercise on chronic diseases among the urban elderly in Khon Kaen province, northeast Thailand. **Methods:** A cross-sectional, descriptive study was employed, using systematic sampling. The study group included 776 elders, 60 or more years of age, living in two urban communities in Khon Kaen. A structured questionnaire was used to collect information between July and September 2007. **Results:** The response rate was 97.1%. The sampled elders comprised more females than males (mean age 67.8, SD 6.5). Most of the sample (612, 78.8%) had completed primary school. Many of the elderly (43.8%) perceived their health status to be of a moderate level, while 35.9% thought it poor. The common underlying diseases were musculoskeletal pain (19.62%), hypertension (18.52%), diabetes mellitus (17.59%), and cardiovascular diseases (7.5%). The proportion of the elderly who do physical exercise was 23.5% (95%CI 20.46–26.85), and the most common types were walking (22.4%), doing housework (21.1%), and aerobic exercise (14.2%). The mean of duration of exercise was 45 min per day (SD 13.56) and the mean frequency was 3.01 times per week (SD 1.14). Physical exercise was significantly associated with perceived health status and current chronic disease (p < .05). The elderly found that physical exercise made them healthier. **Conclusion:** The proportion of urban elders who exercise was only 23.5%. The urban elderly sampled perceived that the type(s) and duration of exercise(s) were appropriate for their age and health and indeed made them healthier.
Acupuncture Combined With an Exercise Program Increases Daily Steps in Older People with Musculoskeletal Problems: A Preliminary Study

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**Background:** It is well established that regular physical activity (PA) can prevent cardiovascular disease and retain optimal function in activities of daily living (ADL) in elderly people. However, PA decreases with age. The decreased PA does not only result from lifestyle factors especially found among older people. Health problems such as pain, limited flexibility, stiffness, and functional disability from osteoarthritis (OA) of the knee or chronic low back pain (CLBP) also represent important barriers to PA. Previous studies have demonstrated that low-intensity resistance exercise or acupuncture results in the improvement of health problems related to OA of the knee or CLBP. **Objective:** To determine whether acupuncture combined with exercise would increase the level of PA assessed by the number of daily steps and improve functional performance in elderly people with OA of the knee or CLBP. **Participants:** Three older people with OA of the knee (two women and a man, aged 69–72 years) and five older people with CLBP (three women and two men, aged 63–79 years) were included for analysis in the study. **Interventions:** Subjects received acupuncture combined with weight-bearing resistance and a stretching exercise program for 8 weeks. Each subject was given acupuncture two times per week and implemented the exercise program five times per week (two supervised group sessions and three unsupervised home sessions). Subjects were not instructed to increase their daily level of PA. **Measurements:** The outcome measures were the number of daily steps (measured by a pedometer, total number of daily steps, and the number of steps continued for over 10 min) as PA level, quadriceps femoris strength (isokinetic muscle strength at angular velocities of 60°/s), physical fitness test (distance of sit-and-reach, timed sit-ups, time of 10-m hurdle walking, and time of one leg standing with eyes open), level of pain, stiffness, and functional disability of knee (assessed by Western Ontario and McMaster Universities osteoarthritis index: WOMAC and radiography) and degree of dysfunction of CLBP (assessed by Roland-Morris disability questionnaire: RMQ and magnetic resonance imaging: MRI). **Results:** A significant increase in total number of daily steps (from 3,990 ± 953 steps/day to 5,384 ± 1,420 steps/day, M ± SD, p = .004) and distance of sit-and-reach (from 30.9 ± 8.0 cm to 36.0 ± 8.8 cm, p = .006) was noted after the program. The number of steps continued for over 10 min had a tendency to increase after the program (from 325 ± 412 steps/day to 1,079 ± 960 steps/day, p = .051). There was no significant difference in quadriceps femoris strength, timed sit-ups, time of 10-m hurdle walking, time of one leg standing with eyes open, WOMAC score, or RMQ score after the program. **Conclusion:** In older people with symptomatic knee OA and CLBP, acupuncture combined with exercise increases the number of daily steps. To establish these findings, further research with a larger number of subjects and comparison with controls is required.
Physiological Responses Over the Time Course During Sustained Passive Muscle Stretch in Prehypertensive Individuals

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Prehypertension as a new classification of blood pressure indicates increased risk of developing hypertension and cardiovascular diseases compared with those with normal blood pressure. To prevent the progression from prehypertension to hypertension, aerobic exercise is effective to lower blood pressure. However, because exaggerated blood pressure induced during exercise increases the risk for occult cardiac events, application of exercise to prehypertensive or hypertensive individuals has largely been avoided. The cause of this excessive blood pressure response during acute bouts of exercise still remains an open question. To answer this question, this study investigated whether group III muscle afferents play an important role eliciting the abnormal blood pressure response mediated during passive muscle stretch in hypertensive individuals. Eleven middle-aged prehypertensive men (132/90 mmHg) and nine middle-aged normotensive men (119/83 mmHg) participated in this study. After a 10-min-rest baseline data collection, a foot of the subject was flexed (dorsiflexion) by an automated Cybex for 1 min. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), heart rate (HR), stroke volume (SV), and cardiac output (CO) were continuously measured on a beat-by-beat basis from a finger via a Finapres device, and total peripheral resistance was calculated. To evaluate the role of exercise pressor reflex, the time course of group III mechanoreflex-induced alterations in SBP, DBP, and MAP were examined. The results showed that the pressor response mediated by the muscle mechanoreflex was significantly higher in prehypertensive individuals compared with the normotensive individuals. CO and TPR tended to be higher in hypertension, but there was no significant difference between the two groups. It is concluded that excessive pressor response produced during exercise in hypertension may be due to dysfunction of the exercise pressor reflex. Whether improvement in exercise pressor reflex function could help reduce abnormal blood pressure response during exercise requires further investigation.

Changes of VO\textsubscript{2max} According to Sex, Age, and Related Factors in Korean Adults

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\textbf{Background}: There is a lack of data on average Korean VO\textsubscript{2max} values. This study attempted to determine average values of VO\textsubscript{2max} corresponding to each age group of Koreans. This study was also designed to investigate the factors associated with VO\textsubscript{2max}. \textbf{Methods}: From May 1, 2000, to January 30, 2006, we recruited 21,458 subjects who visited the health promotion center at one university hospital. We obtained data related to age and exercise by self-administered questionnaire; weight, height, and blood pressure by instrumental measurements; and hemoglobin and cholesterol by overnight fasting blood samples. VO\textsubscript{2max} was estimated by submaximal bicycle ergometer test. \textbf{Results}: The number of research subjects was 21,458—males 12,646 (58.9%) and females 8,812 (41.1%)—and the average age was 48.6 (± 10.05) years with an age range of 20–79 years. The average VO\textsubscript{2max} was 26.4 (± 6.77;
ml/kg/min) for men and 19.8 (± 5.94; ml/kg/min) for women. Relating to factors such as age, VO\textsubscript{2max}, SBP, DBP, cholesterol, Hb, and body mass index, there were significant statistical differences between the sexes (p < .05). For both sexes, VO\textsubscript{2max} decreased as age, cholesterol, BP, and BMI increased. The regular exercise group showed a significantly higher VO\textsubscript{2max} than the nonexercise group for both sexes. **Conclusion:** The average VO\textsubscript{2max} values for Koreans, according to sex and age group, are reported in this study. The decreasing VO\textsubscript{2max} may be attributed to increasing age, BP, cholesterol, and BMI and nonexercise.

**Nutrition and Weight Management in Relation to Physical Activity**

**Characteristics of Physical Activities and Nutritional Intake in Elderly Volunteers**

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**Introduction:** Presently, 20% of the Japanese population is aged 65 years or above, and this percentage is expected to exceed 30% in the near future. In such a society, the preparation of conditions to allow elderly people to remain active members of society is considered necessary. Actually, many elderly people are interested and engaged in volunteer activities. In this study, we evaluated characteristics of physical activities and nutritional intake of such elderly volunteers. **Methods:** The subjects were 77 people (30 males and 47 females) aged 60 years or above (mean age, 70.8 years in males and 72.9 years in females) consisting of participants in a disability prevention supporter training program and subjects of a metabolic experiment using dual-labeled water (DLW). The body build, physical activity (uniaxial accelerometer Lifecorder, Suzuken), and nutritional intake (Wellness21, Co.) were studied for 1 week in the participants in the training program and for 2 weeks in the subjects of the DLW experiment. **Results:** The mean BMI of the subjects was lower in both males and females than the national averages. The mean daily numbers of walking steps in our subjects (11,172 in the males aged 60–69 years and 7,446 in those aged 70 years or above; 10,286 in the females aged 60–69 years and 7,442 in those aged 70 years and above) were higher by about 4,000 steps in those aged 60–69 years and 2,000–3,500 steps in those aged 70 years and above than the national averages at comparable age levels according to the national nutritional and health surveys and by about 2,500 steps than the target for elderly people set by Health Japan 21. The mean PAL calculated from the values indicated by Lifecorder and standard values of basal metabolism was 1.46 with no difference by gender or age. The durations of activities at different intensity levels (Lifecorder METs) were 57 min for METs 2–4, 12 min for METs 5–6, and 2 min for METs 7–9 with no difference between males and females. Concerning diet, the subjects showed higher intakes of protein and fat than the averages in elderly Japanese, and the energy intake was balanced with the activity level. **Discussion:** The physical activity level measured with a uniaxial accelerometer has been reported to be underestimated, as was also indicated by the results of the DLW experiment in our subjects. In consideration of this, the physical activity level of our subjects was higher than the reported values in elderly people, and their energy intake was appropriate.
for the activity level. The results of this study suggest that positive involvement in social activities such as supporting disability prevention of enfeebled elderly people and being subjects in scientific research contribute to the maintenance of an appropriate activity level and adequate diet by increasing the duration of activities at 2–4 METs.

Proposal on Multidynamic Documentation and Performance Device

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The purpose of this study is to assimilate a variety of previous design techniques with new technology, and reconstruct as a synthetic design technique for explanatory contents accompany movement. That is, to unify static, dynamic and interactive expression into one inside of 3-dimensional space, and to propose a contents using MDD (multidynamic documentation), which is a dynamic and interactive visual expression technique. The proposed contents, against general ways of thinking for making contents “think as separated pages,” have a feature by which parallel pages are grouped together inside a 3-dimensional space accompany movement. It is possible for users to view contents instinctively. By using 3-dimensional space, users can not only view all needed information, but also keep a sequence of the whole contents. By increasing the amount of information on one page however, the amount of data that should be processed is also increased. This content was able to set the lesser amount of data using proposing technique through case study. The MDD concept of this paper has various possibilities for application for contents accompany movement. The range of application suits the following: content accompany movement, movement itself is content and explanations for mechanism. The operation of this contents uses humans’ natural movement instead of a mouse or pointing devices. It is possible to communicate more efficiently using this developed performance device. It can be considered that with documents which have the MDD element and performance device as an interface, more valuable communication environment is constructed by applying them to various fields.