BOOK OF

SPORT SCIENCE

PUBLICATIONS

By The
PESS Faculty Staff Members
<table>
<thead>
<tr>
<th>Number</th>
<th>Author/Contributor</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Govindasamy BALASEKARAN</td>
</tr>
<tr>
<td>11</td>
<td>Michael CHIA</td>
</tr>
<tr>
<td>15</td>
<td>WANG Chee Keng, John</td>
</tr>
<tr>
<td>21</td>
<td>CHOW Jia Yi</td>
</tr>
<tr>
<td>27</td>
<td>TAN Kwang San, Steven</td>
</tr>
<tr>
<td>31</td>
<td>CHEW Wai Cheong Eugene</td>
</tr>
<tr>
<td>35</td>
<td>KEE Ying Hwa, Adrian</td>
</tr>
<tr>
<td>38</td>
<td>KOH Koon Teck</td>
</tr>
<tr>
<td>44</td>
<td>KONG Pui Wah, Veni</td>
</tr>
<tr>
<td>52</td>
<td>LENG Ho Keat</td>
</tr>
<tr>
<td>54</td>
<td>LIM Boon San, Coral</td>
</tr>
<tr>
<td>60</td>
<td>Masato KAWABATA</td>
</tr>
<tr>
<td>65</td>
<td>PARK Chanmin</td>
</tr>
<tr>
<td>70</td>
<td>PYUN Do Young</td>
</tr>
<tr>
<td>76</td>
<td>Stephen Francis BURNS</td>
</tr>
<tr>
<td>82</td>
<td>Swarup MUKHERJEE</td>
</tr>
<tr>
<td>88</td>
<td>Tiago M. BARBOSA</td>
</tr>
<tr>
<td>94</td>
<td>YANG Yifan</td>
</tr>
<tr>
<td>101</td>
<td>GOH-LEONG Lai Keun</td>
</tr>
<tr>
<td>103</td>
<td>Mohammed Azhar Bin YUSOF</td>
</tr>
<tr>
<td>106</td>
<td>Nicholas Giles APLIN</td>
</tr>
<tr>
<td>111</td>
<td>TAN Cher Chay, John</td>
</tr>
<tr>
<td>113</td>
<td>TAN Wee Keat, Clara</td>
</tr>
<tr>
<td>119</td>
<td>CHIAN Lit Khoon</td>
</tr>
<tr>
<td>121</td>
<td>CHUNG Ho Jin</td>
</tr>
<tr>
<td>129</td>
<td>THOR Dianna</td>
</tr>
<tr>
<td>131</td>
<td>Saravana Pillai ARJUNAN</td>
</tr>
</tbody>
</table>
SELECTED PUBLICATIONS

Determination and Validation of Maximal Aerobic Speed

Prediction of Running Performances Utilizing the Running Energy Reserve Index

OMNI Scale of Perceived Exertion: mixed gender and race validation for Singapore children during cycle exercise

Short-term pharmacologically induced growth study of ontogenetic allometry of oxygen uptake in children

Association of Interleukin-15 protein and Interleukin-15 Receptor Genetic Variation with Resistance Exercise Training Responses

Exercise-Induced Weight Loss Preferentially Reduces Abdominal Fat

Prediction of 2000m Indoor Rowing Performance Using a 30 s Sprint and Maximal Oxygen Uptake

Insulin sensitivity in African-American Children With and Without Family History of Type 2 Diabetes

Govindasamy BALASEKARAN
Ph.D

Current Appointments
Head, PESS
Associate Professor

Research Interest
• Human Performance
• Exercise Biochemistry
• Metabolism and Genetics

Contact Information
Phone: 6790 3686
Email: govindasamy.b@nie.edu.sg
Office location: NIE 5-03-37
Determination and Validation of Maximal Aerobic Speed


Maximal aerobic speed (MAS) is usually determined at the velocity at $\dot{V}O_2\text{max}$ ($v\dot{V}O_2\text{max}$). However the accuracy may be questioned since MAS at $v\dot{V}O_2\text{max}$ elicits a higher amount of anaerobic energy. **Purpose:** To determine and validate the criteria of MAS at a speed which elicits maximal and minimum contribution of aerobic and anaerobic energy. **Methods:** 9 sprint trained (ST) (age = 26.89±9.39 yrs, BMI = 23.09±2.07 kg•m$^{-2}$) and 12 endurance trained (ET) (age = 31.67±7.24 yrs, BMI = 21.34±1.27 kg•m$^{-2}$) athletes participated to determine MAS. 19 healthy participants (age = 29.74±8.31 yrs, BMI = 22.01±2.12 kg•m$^{-2}$) were also selected to validate the criteria of MAS. To determine MAS, athletes performed five-six treadmill sessions as follows: Astrand modified running test, submaximal discontinuous test, $\dot{V}O_2$ till exhaustion ($T_{lim}$) test at $v\dot{V}O_2\text{max}$ and $V_{\text{sub}95}\left[v\Delta50\right]$ (median of $v\dot{V}O_2\text{max}$ and velocity at lactate threshold; $vLT$) or $v\Delta50+5\%v\dot{V}O_2\text{max}$] and speed and duration curve protocol. To validate the criteria of MAS, participants also performed $T_{lim}\dot{V}O_2\text{max}$. Using the hyperbolic nonlinear relation, MAS was determined at its duration ($MAS_{\text{dur}}$) which was calculated by eventually adding the $T_{lim}\dot{V}O_2\text{max}$ converted in $T_{lim}V_{\text{sub95}}$ using the following equations:

$$T_{lim}\dot{V}O_2\text{max}v\dot{V}O_2\text{max} = T_{lim}v\dot{V}O_2\text{max} - TA\dot{V}O_2\text{max} v\dot{V}O_2\text{max}$$

$$T_{lim}\dot{V}O_2\text{max} \text{converted (s)} = \frac{T_{lim}\dot{V}O_2\text{max}v\dot{V}O_2\text{max} \times v\dot{V}O_2\text{max}}{V_{\text{sub}95}}$$

**Results:** The MAS was at 92.45±1.47%$v\dot{V}O_2\text{max}$ and 89.27±3.56%$v\dot{V}O_2\text{max}$ among ET and ST cohorts, respectively. The ET athletes achieved significantly ($p\leq.001$) higher MAS (16.07±1.58km•h$^{-1}$) at shorter duration ($MAS_{\text{dur}} = 678.59±165.44s, p\leq.05$) than ST athletes (MAS=12.77±.81km•h$^{-1}$; $MAS_{\text{dur}}=840.28±164.97s$). To validate the criteria of MAS, the oxygen uptake at MAS (50.69±4.69ml•kg$^{-1}$•min$^{-1}$; 96.08±2.51%$\dot{V}O_2\text{max}$) was not significantly ($p\geq.05$) different from 95%$\dot{V}O_2\text{max}$ among all participants. The blood lactate (mmol•L$^{-1}$) at MAS (7.80±1.52) was significantly ($p\leq.01$) lower than at $\dot{V}O_2\text{max}$ (9.11±2.50) and $\dot{V}O_2\text{max}$ (8.59±1.62). **Conclusion:** The determination of MAS required a subtraction of $T_{lim}\dot{V}O_2\text{max} \text{converted}$ from $T_{lim}V_{\text{sub95}}$ as it eliminated some anaerobic energy contribution. In addition, MAS may be more accurate if measured at $%v\dot{V}O_2\text{max}$ and not at $v\dot{V}O_2\text{max}$. The MAS at 91.08%$v\dot{V}O_2\text{max}$ among athletes may be accurate as it represents maximal aerobic energy with minimal contribution from anaerobic energy sources.

Mathematical and physiological models to predict running performances are generally based on unverified assumptions which may reduce accuracy. Few models are able to predict for a wide range of distances. **Purpose:** To predict all out 200m and 5000m track and treadmill running performances ranging from .19 s~ to 1339 s~ utilizing the running energy reserve index (RERI). **Methods:** 29 athletes [total: age: 27.31 ± 7.16 yrs, BMI: 22.04 ± 1.95 kg•m^-2; endurance trained; ET = 9, sprinters; ST = 7 and middle distance; MD = 13] participated in this study. Additionally, 12 participated (age: 24.45 ± 6.44 yrs, BMI: 21.43 ± 2.15 kg•m^-2) to calculate the value of c constant of the RERI model based on rational function. To determine maximal aerobic speed (MAS) athletes performed five-six laboratory sessions as follows: Astrand modified running maximal oxygen consumption test, submaximal discontinuous treadmill (SUBMAX) test, VO2 till exhaustion (Tlim) tests at; velocity at VO2max (vVO2max), vΔ50 (median of vVO2max and velocity at lactate threshold; vLT) or vΔ50+5%vVO2max and speed and duration curve protocol. Maximal anaerobic speed (MAnS) was determined with a 50m sprint on the track. Also, athletes performed two all-out 200m and 5000m track runs. The maximal aerobic energy (EMAS) and maximal anaerobic energy (EMAnS) at corresponding speeds and estimated energy for 200m, 5000m and treadmill runs were established with submaximal efficiency equations. The RERI was computed with the ratio of EMAnS and EMAS. Rational regression equation was fitted to the data of estimated energy at corresponding speeds of 200m, 5000m track runs and treadmill running trials as functions of run duration. **Results:** The measured value of c constant was .0185 with no significant differences between ET, ST and MD athletes. The predicted (P) and experimental (E) results for the total cohort had significant correlations from .96 to .99 (p≤.01): EMAnS (ml•kg^-1•s^-1) [P(1.79 ± .24), E(1.78 ± .24)]; EMAS (ml•kg^-1•s^-1) [P(0.80 ± .1), E(0.81 ± .11)] and RERI [P(2.25 ± .36), E(2.23 ± .32)]. The RERI model predicted track and treadmill all out running performances to within an average of 2.26 ± 1.89 % ($R^2 = .99$) and 2.95 ± 2.51 % ($R^2 = .99$) respectively. **Conclusion:** The RERI model may be accurate in predicting all out track and treadmill running performances for a wide range of distances from short, middle up to 5000m.

The children’s OMNI Scale of Perceived Exertion (RPE) has not been validated for children of Asian origin. The purpose was to validate the RPE for Singapore children, 12–15 years. 81 children of male and female of Chinese, Malay, and Indian ethnicities participated in the study. A cross-sectional, perceptual estimation paradigm using a multistage cycle ergometer protocol was used. Oxygen consumption ($V \cdot O_2$; ml min$^{-1}$), heart rate (HR; beats min$^{-1}$), and RPE for the Overall body (RPE-O), Legs (RPE-L), and Chest (RPE-C) were determined at the end of each continuously administered 3-min power output stage (PO) starting at 25 W with 25 W increments until exhaustion. For validation, linear regression analysis for all PO revealed that RPE-O, RPE-L, and RPE-C for each of the six gender–race and combined cohort distributed as positive linear functions of both $V \cdot O_2$ (ml min$^{-1}$, ml kg$^{-1}$ min$^{-1}$) and HR (beats min$^{-1}$). All regression functions were statistically significant ($P < 0.01$). Differences between undifferentiated (RPE-O) and differentiated (RPE-L and RPE-C) at each PO stage were examined separately for the male (up to PO 8 [200 W]) and female (up to PO 5 [125 W]) cohorts. For the males, RPE-L was greater ($P < 0.05$) than both RPE-C and RPE-O only at PO 8. For the females, RPE-O was greater ($P < 0.05$) than RPE-C only at PO 3 and 4. OMNI Scale validity was established for male and female Asian children of Chinese, Malay, and Indian origin. Male and female children did not perceive the intensity of exertional perceptions to differ between the legs and the chest. As there were no differences between the undifferentiated and differentiated perceptual responses, a dominant signal was not observed.
Short-term Pharmacologically Induced Growth Study of Ontogenetic Allometry of Oxygen Uptake in Children


**Background:** A range of allometric coefficients have been proposed in describing the maximal oxygen uptake (VO2max): body mass relation in children using weight-bearing ergometry. However, a wide deviation in the allometric coefficients for VO2max may be apparent when selected pediatric cohorts are studied in conjunction with clinical intervention for growth abnormalities. **Aim:** The purpose of this study was to determine the allometric coefficients for VO2max after short-term pharmacologically induced growth in pre- and early pubescent children. Subjects and methods: The treatment group consisted of nine subjects with non-growth hormone (GH)-deficient short stature and one with GH-deficient short stature (mean age: 13.7±1.7 years). Ten pre- and early pubescent children matched for age, height, weight, VO2max and body mass index (BMI) were controls. The treatment group were evaluated before (Pre-GH) and after (Post-GH) 4 months of subcutaneous GH therapy (0.05 mgkg_1day_1_6 days week_1). **Results:** The mean ontogenetic coefficient for the treatment group was 1.50±0.20 and for the control group was 0.77±0.34. The mean allometric coefficient for body mass relative to VO2max was significantly higher in the treatment group compared with the control group (p < 0.05). Height, weight, fat free mass (FFM), VO2max and body mass index (BMI) were controls. The treatment group were evaluated before (Pre-GH) and after (Post-GH) 4 months of subcutaneous GH therapy (0.05 mgkg_1day_1_6 days week_1). **Conclusion:** The scaling for oxygen uptake (VO2) for body mass varies with GH treatment and the increase in VO2max that commonly occurs in conjunction with physical growth in the pre-and early pubescent individual may be linked to an increase in FFM and linear size.
**Association of Interleukin-15 Protein and Interleukin-15 Receptor Genetic Variation with Resistance Exercise Training Responses**


Interleukin-15 (IL-15) is an anabolic cytokine that is produced in skeletal muscle and directly affects muscle anabolism in animal and in vitro models. The contribution of IL-15 variability in muscle responses to 10 wk of resistance exercise training in young men and women was examined by measuring acute and chronic changes in IL-15 protein in plasma and characterizing genetic variation in the IL-15 receptor-α gene (IL15RA). Participants trained 3 days a week at 75% of one repetition maximum, performing three sets (6–10 repetitions) of 13 resistance exercises. Plasma IL-15 protein was significantly increased ($P < 0.05$) immediately after acute resistance exercise but did not change with training and was not associated with variability in muscle responses with training. A single nucleotide polymorphism in exon 7 of IL15RA was strongly associated with muscle hypertrophy and accounted for 7.1% of the variation in regression modeling. A polymorphism in exon 4 was also independently associated with muscle hypertrophy and accounted for an additional 3.5% of the variation in hypertrophy. These results suggest that IL-15 is an important mediator of muscle mass response to resistance exercise training in humans and that genetic variation in IL15RA accounts for a significant proportion of the variability in this response.

**Exercise-Induced Weight Loss Preferentially Reduces Abdominal Fat**


**Purpose:** To investigate whether abdominal fat is reduced in response to substantial weight loss induced by exercise in young obese men. **Methods:** Thirty obese men (mean age 19.2 ± 1.3 yr) were evaluated before (pretraining) and after (posttraining). There were 30 obese male subjects (mean age 19.2 ± 1.3 yr) without training who were monitored as control subjects. Fat free mass (FFM), fat mass, and percent body fat were determined from skinfold measurements. Differences between pre- and posttraining responses were analyzed with a paired $t$-test. **Results:** Subjects lost 12.0 ± 3.6 kg ($P < 0.001$) from pre- to posttraining, which was attributable to a reduction in fat mass ($P < 0.001$), as FFM was unchanged. Both waist circumference (WC) and hip circumference (HC) decreased ($P < 0.01$), the reduction in WC (13.7%) being greater than the reduction in HC (7.7%) as reflected by the decrease in waist-to-hip ratio (WHR; $P < 0.001$). These data reveal that large exercise-induced weight losses are associated with maintenance of FFM. The significant reduction in WHR indicates a greater mobilization of abdominal fat and a preferential loss of fat from this region. **Conclusions:** Large exercise-induced weight loss is associated with a preferential reduction in abdominal fat and a corresponding maintenance of FFM. Such an effect on body composition should reduce disease risk and the eventual weight regain that typically follows diet-induced weight losses with obese subjects.
Prediction of 2000 m Indoor Rowing Performance Using a 30 s Sprint and Maximal Oxygen Uptake


The aim of this study was to predict indoor rowing performance in 12 competitive female rowers (age 21.3 - 3.6 years, height 1.68 - 0.54 m, body mass 67.1 - 11.7 kg; mean - s ) using a 30 s rowing sprint, maximal oxygen uptake and the blood lactate response to submaximal rowing. Blood lactate and oxygen uptake (V O 2 ) were measured during a discontinuous graded exercise test on a Concept II rowing ergometer incremented by 25 W for each 2 min stage; the highest V O 2 measured during the test was recorded as V O 2max (mean = 3.18 - 0.35 l·min⁻¹). Peak power (380 - 63.2 W) and mean power (368 - 60.0 W) were determined using a modified Wingate test protocol on the Concept II rowing ergometer. Rowing performance was based on the results of the 2000 m indoor rowing championship in 1997 (466.8 - 12.3 s). Laboratory testing was performed within 3 weeks of the rowing championship. Submitting mean power (Power), the highest and lowest five consecutive sprint power outputs (Maximal and Minimal), percent fatigue in the sprint test (Fatigue), V O 2max (l·min⁻¹), V O 2max (ml·kg⁻¹·min⁻¹), V O 2 at the lactate threshold, power at the lactate threshold (W), maximal lactate concentration, lactate threshold (percent V O 2max ) and V E max (l·min⁻¹) to a stepwise multiple regression analysis produced the following model to predict 2000 m rowing performance: Time 2000 = -0.163 (Power)14.213 · ( V O 2max l·min⁻¹) + 0.738· (Fatigue) + 567.259 ( R 2 = 0.96, standard error = 2.89). These results indicate that, in the women studied, 75.7% of the variation in 2000 m indoor rowing performance time was predicted by peak power in a rowing Wingate test, while V O 2max and fatigue during the Wingate test explained an additional 12.1% and 8.2% of the variance, respectively.
Insulin sensitivity in African-American Children With and Without Family History of Type 2 Diabetes


Objective: African-Americans are at increased risk for type 2 diabetes. We have previously demonstrated that African-American children are hyperinsulinemic and insulin resistant compared with their white American peers. The aim of the present investigation was to assess the impact of family history of type 2 diabetes on insulin sensitivity in African-American children. Research Design and Methods: A total of 13 prepubertal healthy children with negative family history (FH-) and 9 with positive family history (FH+) of type 2 diabetes underwent a 3-h hyperinsulinemic (40 mU x m(-2) x min(-1))-euglycemic clamp study to assess insulin sensitivity. The groups were comparable for age, pubertal status, total body adiposity determined by dual-energy X-ray absorptiometry, abdominal adiposity assessed by computed tomography scan at the level of L4-5 lumbar vertebra, and physical fitness measured by maximal oxygen consumption (VO2max). Results: The FH+, compared with the FH-, group had lower insulin-stimulated glucose disposal (10.9 +/- 1.2 vs. 14.2 +/- 0.9 mg x kg (-1) x min (-1), P = 0.035) and lower nonoxidative glucose disposal (5.7 +/- 0.8 vs. 8.3 +/- 0.6 mg x kg (-1) x min (-1), P = 0.015), with no differences in rates of glucose oxidation, fat oxidation, or insulin-mediated free fatty acid suppression. Fasting hepatic glucose production assessed with [6, 6-2H2] glucose and basal rates of glucose and fat oxidation were not different between the two groups. Conclusions: These data suggest that in African-American children, family history of type 2 diabetes is a risk factor for insulin resistance. These children manifest important metabolic alterations, including impaired insulin-stimulated total and nonoxidative glucose disposal early in the first decade of life. We propose that this familial tendency, combined with environmental influences, could lead to type 2 diabetes decades later.
SELECTED PUBLICATIONS

Fit for Study & Play- The Holistic Development of Primary School Pupils in Singapore

Inactivity Physiology- Standing Up for Making Sitting Less Sedentary at Work

PRIDE for PLAY in Singapore- 2010 WLO Innovation Prize- Highly Commended Award

Still and Heavy- Obesity and Physical Inactivity among Singaporean Youths-Consequences and Challenges for the 21st Century

Current Appointments
Dean, FACULTY AFFAIRS
Professor of Pediatric Exercise Physiology
Vice-President Asian Council of Exercise and Sports Science
Vice-Chairman, Beacon Primary School Advisory Board

Research Interest
- Pediatric Exercise Physiology
- Physical Education

Contact Information
Phone: 6790 3081
Email: michael.chia@nie.edu.sg
Office location: NIE 1-04-05A

The research investigated the health-related quality of life of 1078 lower primary school students (age 7-9 years) in two schools- Beacon Primary School (EXPT School) and an equivalently matched school, Bukit Panjang Primary School (CON School)- using the Pediatric Quality of Life (PEDsQL 4.0) Questionnaire. The EXPT School has an Interactive-Digital-Media-enriched teaching environment and also uses an integrative programme to teach Physical and Health Education (PHE), Civics and Moral Education (CME) and Pastoral Care (PC), collectively called the Wellness Channel (WC). An objective of the research was to quantify the amount of amalgamated physical activity in the EXPT School as a result of the WC in comparison to the CON School, which has the regular sessions of PE. Within-school step count was monitored over five days, and averaged while total daily step count was monitored over a single weekday using a motion sensor (HJ-005 E pedometer). Academic performance in annual tests of three major subjects (English, Mathematics and Second Language) was collected. Pre-to-post results showed that the within-school step count remained unaltered in the CON School (change of 647 in boys and 436 steps in girls; p>0.05) while it increased nearly 50% in boys (change of 2473 steps, p<0.05) and 40% in girls (change of 2067 steps, p<0.05) in the EXPT School over 40 weeks. Nonetheless, total daily step count (sum of steps accumulated within and outside of school) was unaltered in pupils from EXPT (change of 404-440 steps, p>0.05) and CON (change of 209-296 steps, p>0.05) Schools. Pupils accomplished 52-58% and 72-76%, respectively, of the recommended daily amalgamated step count of 16 000 for boys and 13 000 for girls. At the baseline assessment, pupils from the EXPT and CON had high, but not significantly different PEDsQL Total Health scores (81 versus 80, p>0.05) between schools. After the intervention, the PEDsQL improved by 3% (p<0.05) for the EXPT School with no change for the CON School (-0.4%, p>0.05). Amalgamated pupil data of the EXPT and CON schools showed that a higher body mass index (BMI) negatively affected academic performance while a higher Total Health score was associated with a higher academic achievement.
Emergent research suggests that prolonged sitting throughout the day over long periods of time in adults is significantly associated with chronic diseases such as diabetes, heart disease, hypertension and some cancer forms. Singaporean youths and adults respectively, are not sufficiently active during schooling and at work. This pervasive exposure to prolonged sitting in youth and adulthood (e.g. more than four hours daily) expose large segments of the population to health risks and increased all-cause mortality. Some researchers describe ‘prolonged sitting’ as the new ‘smoking’ disease, because of it could be a serious threat to optimal physical and metabolic health. Interventions to fragment sitting time involve the use of standing desks or treadmill workstations but these have produced mixed results since prolonged standing could give rise to other health ailments that are associated with too much standing while expensive desk treadmills would be impractical and are beyond the reach for most people. Moreover, it is inconceivable that treadmill desks could be used in work group discussions. The use of a seat cycle, to sit and cycle at the same time is an innovative approach at intervening where it makes sense, where its use is not intrusive and could be ‘assimilated’ into the work culture. The use of the seat cycle even challenges the notion and definition that prolonged sitting is sedentary. This case study briefly describes the key concepts and ingredients of an on-going pilot 3-month intervention study that examines the feasibility and utility of making sitting less sedentary at the National Institute of Education in Singapore. Results emanating from the study would provide empirical data for product innovation and development, strong opportunities for interdisciplinary collaborations among product engineers, sensor scientists, medical practitioners and health-promotion advocates at worksites.
PRIDE for PLAY in Singapore - 2010 WLO Innovation Prize - Highly Commended Award


PRIDE for PLAY is a school-based intervention programme, which allows primary schools to capitalize on children’s innate proclivity for play on a daily basis. Play is a fundamental antidote to a youth lifestyle that is increasing sedentary even though many useful things are accomplished while being still. Daily play provides a much need balance between being physically active and being physically still. The innovative programme extracts three minutes from other time-tabled subject lessons in the lower primary levels (10 periods per day) and aggregates it to form an embedded 30-minute play session that is incorporated as a daily activity. The benefits of daily play include the natural development and nurturance of social emotional learning outcomes and values inculcation such as team work, racial integration, social and cultural sensitivity, negotiation, responsibility, coping with winning and losing, confidence and resilience. Research data on PRIDE for PLAY, distilled over a two-year-period show increased daily physical activity, improved teacher-pupil bonding and understanding, improved school ethos, increased concentration and less disruptive pupil behavior in class, no increased incidence of injuries and no decline in academic performance. Feedback from the stakeholders- pupils, parents, teachers and school leaders – were all praise for PRIDE for PLAY for its innovativeness, authenticity, simplicity, feasibility, efficacy, scalability and low cost.

Still and Heavy- Obesity and Physical Inactivity among Singaporean Youths- Consequences and Challenges for the 21st Century


Singaporean youths are a very sedentary lot where current levels of habitual physical activity in school and outside of school are grossly inadequate to meet guidelines for having a normal body mass index and for good metabolic health. Though youth obesity rates among Singaporeans appear to be stable over the last 10 years, hovering about 10%, emergent evidence shows that Singaporean youth who were sitting for too much of the day, as a consequence had twice the risk of suffering from insulin resistance which is a precursor to metabolic syndrome. Sedentary behaviours including schooling-associated activities have also contributed to worrisome rates of myopia among young people. Inactive physiology research among Singaporean youths represents a challenge and a fertile area for future research attention. Innovative whole school, home and community approaches are required to keep active youths moving on a sustained basis and to engage sedentary youths in becoming physically active.
SELECTED PUBLICATIONS

- Longitudinal Changes in Physical Fitness Performance in Youth: A Multilevel Latent Growth Curve Modeling Approach
- Impact of the Talent Development Environment on Achievement Goals and Life Aspirations in Singapore
- Understanding Motivation in Internet Gaming Among Singaporean Youth: The Role of Passion
- Influence of Perceived Motivational Climate on Achievement Goals in Physical Education: A Structural Equation Mixture Modeling Analysis
- An Experimental Test of Cognitive Dissonance Theory in the Domain of Physical Exercise
- Passion and Intrinsic Motivation in Digital Gaming
- The 2 X 2 Achievement Goal Framework in a Physical Education Context
- Cross-Cultural Validation of the Conceptions of the Nature of Athletic Ability Questionnaire Version 2
- Intrinsic Motivation Towards Sports in Singaporean Students: The Role of Sport Ability Beliefs
- Motivation and Self-Perception Profiles and Links with Physical Activity in Adolescent Girls

WANG Chee Keng, John Ph.D. C Psychol

Current Appointments
Professor
Leader, Motivation in Educational Research Lab

Research Interest
- Sport and Exercise Psychology
- Motivation
- Achievement Goals
- Statistical Analysis
- Structural Equation Modeling
- Multilevel Analysis
- Latent Growth Curves Analysis

Contact Information
Phone: 6790 3693
Email: john.wang@nie.edu.sg
Office location: NIE 5-03-28
Longitudinal Changes in Physical Fitness Performance in Youth: A Multilevel Latent Growth Curve Modeling Approach


Using a multilevel latent growth curve modeling (LGCM) approach, this study examined longitudinal change in levels of physical fitness performance over time (i.e. four years) in young adolescents aged from 12–13 years. The sample consisted of 6622 students from 138 secondary schools in Singapore. Initial analyses found between-school variation on fitness test scores with intra-class correlations ranging from 0.02–0.19. Subsequent multilevel growth curve analyses revealed a quadratic trend of the longitudinal data across five stations of performance tests, with significant within-school student variability in change over time. The result of the multilevel LGCM showed that there were strong school effects on all of the physical fitness performances, in addition to inter- and intra-individual differences.

Keywords: Multilevel latent growth curve, longitudinal change, fitness tracking, fitness testing, latent growth curve modeling

Impact of the Talent Development Environment on Achievement Goals and Life Aspirations in Singapore


Producing successful athletes in Singapore is a high priority, and the financial rewards for those that make it are great. In light of such an extrinsically motivated structure, the purpose of the current study was to examine the impact of the talent development environment on the goal pursuits and life aspirations of young athletes. Intrinsic goal striving was predicted by a mastery approach and an environment that prioritized long-term development and fundamentals, and provided a good support network. On the contrary, a lack of quality preparation and understanding of athletes promoted extrinsic goal-striving, as did both performance-approach and performance-avoidance goals.

Keywords: Talent development, goal pursuits, achievement goals, intrinsic and extrinsic goals
Understanding motivation in internet gaming among Singaporean youth: The role of passion


This study examined the motivation of young people in internet gaming using the dualistic model of passion. Path analysis was used to examine the relationships between the two types of passion: obsessive and harmonious passion, behavioral regulations, and flow. A total of 1074 male secondary school students from Singapore took part in the study. The results of the path analysis showed that external, introjected, and identified regulations positively predicted obsessive passion, while harmonious passion was predicted by identified and intrinsic regulations. Flow in digital gaming was predicted directly by harmonious passion, as well as indirectly through intrinsic regulation. This study supports the proposed dualistic model of passion in explaining young people’s motivation in internet gaming.

Influence of Perceived Motivational Climate on Achievement Goals in Physical Education: A Structural Equation Mixture Modeling


The purpose of the current study was to examine the influence of perceived motivational climate on achievement goals in Physical Education (PE) using a structural equation mixture modelling (SEMM) analysis. Within one analysis, we identified groups of students with homogenous profiles in perceptions of motivational climate and examined the relationships between motivational climate, 2 x 2 achievement goals and affect, concurrently. The findings of the present study showed that there were at least two distinct groups of students with differing perceptions of motivational climate, one group of students had much higher perceptions in both climates compared to the other group. Regardless of their grouping, the relationships between motivational climate, achievement goals, and enjoyment seemed to be invariant. Mastery climate predicted the adoption of mastery-approach and mastery-avoidance goals, performance climate were related to performance-approach and performance-avoidance goals. Mastery-approach goal had a strong positive effect while performance-avoidance had a small negative effect on enjoyment. Overall, it was concluded that only perception of a mastery motivational climate in physical education may foster intrinsic interest in PE through adoption of mastery-approach goals.

*Keywords*: Achievement goals, motivational climate, latent profile analysis, SEM mixture model
An Experimental Test of Cognitive Dissonance Theory in the Domain of Physical Education


The present study examined cognitive dissonance-related attitude change in the domain of exercise. Experimental participants made a decision to perform a boring exercise task (stepping on a bench/chair) under three different conditions: a free-choice condition (*n* = 33, Male = 17 female = 16, *Age* = 14.57), under a no-choice/control condition (*n* = 28, Male = 15, Female = 13, *Age* = 14.50), and under a condition that compelled participants to practice bench/chair stepping (forced-choice condition) (*n* = 31, Male = 15, Female = 16, *Age* = 14.61). Results showed that participants in the free-choice condition reported more positive attitudes than participants in the control condition and participants in the forced-choice condition. Ancillary analysis indicated that cognitive dissonance is experienced as an aversive state, and that the amount of frustration that participants experienced immediately after the free-choice paradigm predicted attitudes.

Passion and Intrinsic Motivation in Digital Gaming


Digital gaming is fast becoming a favorite activity all over the world. Yet very few studies have examined the underlying motivational processes involved in digital gaming. One motivational force that receives little attention in psychology is passion, which could help us understand the motivation of gamers. The purpose of the present study was to identify subgroups of young people with distinctive passion profiles on self-determined regulations, flow dispositions, affect, and engagement time in gaming. One hundred fifty-five students from two secondary schools in Singapore participated in the survey. There were 134 males and 8 females (13 unspecified). The participants completed a questionnaire to measure harmonious passion (HP), obsessive passion (OP), perceived locus of causality, disposition flow, positive and negative affects, and engagement time in gaming. Cluster analysis found three clusters with distinct passion profiles. The first cluster had an average HP/OP profile, the second cluster had a low HP/OP profile, and the third cluster had a high HP/OP profile. The three clusters displayed different levels of cognitive, affective, and behavioral outcomes. Cluster analysis, as this study shows, is useful in identifying groups of gamers with different passion profiles. It has helped us gain a deeper understanding of motivation in digital gaming.
**The 2 x 2 Achievement Goal Framework in a Physical Education Context**


**Objectives**: To study the approach-avoidance dimension in research on achievement goals in a physical education setting, in addition to the mastery-performance goal. The psychometric properties of the 2x2 Achievement Goal in Physical Education Questionnaire were tested and the characteristics of distinct goal profiles were examined. **Method**: The three studies involved Singapore children and youth aged 11-18 years (total N=1297). **Results**: Exploratory and confirmatory factor analyses supported the factor structure of the 2 x 2 achievement goal framework in the physical education context. Factorial invariance across gender and athletic status was supported through multi-group analysis. Four distinct clusters were identified reflecting differing psychological characteristics, as well as affective and behavioural outcomes. **Conclusion**: Achievement goal research should reflect approach and avoidance dimensions.

**Cross-Cultural Validation of the Conceptions of the Nature of Athletic Ability Questionnaire Version 2**


The present study examined the cross-cultural validity of the Conceptions of the Nature of Athletic Ability Questionnaire Version 2 (CNAAQ-2) using two samples of secondary school students from the United Kingdom (n = 784) and Singapore (n = 647). The factorial invariance and structural latent mean differences were investigated. Confirmatory factor analyses of both samples supported a structure comprising two higher-order factors of entity and incremental beliefs underpinned by beliefs that athletic ability is stable and a gift (entity) and are open to improvement and can be developed through learning (incremental). The pooled data analysis provided evidence for the cross-cultural applicability of the measurement model. Multigroup analysis demonstrated invariance of the factor forms, factor loadings, factor variances, and factor covariances. However, the latent mean structures of all dimensions measured by the CNAAQ-2 were not equivalent for the UK and Singaporean samples, suggesting that there may be cultural influences in terms of mean scores of the constructs in children and youth across the two countries.

**Keywords**: Ability beliefs, CNAAQ-2, Factorial invariance, Latent mean structure analysis
Intrinsic Motivation towards Sports in Singaporean Students: The Role of Sport Ability Beliefs


This study investigated whether motivational constructs from educational and sport psychology can contribute to our understanding of the determinants of active lifestyles in Singaporean students, thus extending this area of research into a new setting and sample. Participants (N = 155; aged 18 to 35 years) were students attending a teacher-training course in a university in Singapore. First, using confirmatory factor analysis, a measure of lay beliefs concerning sport/athletic ability was confirmed with a new sample. Second, using structural equation modelling, results confirmed hypotheses that beliefs reflecting that athletic ability can be developed over time (incremental beliefs) predict an achievement task (self-referenced) orientation, while beliefs reflecting that athletic ability is relatively stable (entity beliefs) predict an ego (other-person, comparative) orientation. Results also confirmed that goal orientations directly affect perceived competence which, in turn, influences intrinsic motivation to be physically active. A task orientation had a direct link to intrinsic motivation. These findings suggest that intrinsic motivation towards sport and physical activity might be enhanced through interventions that focus on self-referenced and self-improvement notions of ability as well as perceived competence. If perceptions of competence are primarily externally or entity focused, one might predict limited success in enhancing physical activity motivation.

Keywords: Motivation, physical activity, Singapore

Motivation and Self-Perception Profiles and Links with Physical Activity in Adolescent Girls


Research shows a decline in participation in physical activity across the teenage years. It is important, therefore, to examine factors that might influence adolescent girl’s likelihood of being physically active. This study used contemporary theoretical perspectives from psychology to assess a comprehensive profile of motivational and self-perception variables in 11–16 year old English girls (n = 516). A cross-sectional design was employed. Cluster analysis was conducted to (a) map cluster profiles and (b) test whether clusters differed in physical self-worth, global self-esteem, and physical activity. Results revealed a five cluster solution depicting 40% of the sample as moderately motivated, 30% lowly motivated in two clusters, and 30% highly motivated, also in two clusters. However, differences between clusters on physical activity were quite small. Results show potential areas for intervention to enhance the motivation of adolescent girls for physical activity.

Keywords: Physical activity, adolescent girls, motivation, physical self-perceptions, self-esteem
SELECTED PUBLICATIONS

A Dynamical System Perspective to Understanding Badminton Singles Game Play

Nonlinear Learning Underpinning Pedagogy: Evidence, Challenges and Implications

Effects of External and Internal Focus Training on Foot-strike Patterns in Running

Effect of analogy Instructions with an internal focus on learning a complex motor skill

The Effectiveness of Keeper-Independent Penalty Kicks using Fake Visual Cues from Penalty Takers

“How does TGfU Work?”: Examining the Relationship between Learning Design in TGfU and A Nonlinear Pedagogy

Focus of Attention as an Instructional Constraint on Movement Behavior

Nonlinear Pedagogy: Learning Design for Self-Organizing Neurobiological Systems

Coordination Changes in A Discrete Multi-articular Action as a Function of Practice

The Role of Nonlinear Pedagogy in Physical Education

Current Appointments
Sub-Dean, PGDE, Office of Teacher Education
Associate Professor

Research Interest
• Motor Control and Learning
• Nonlinear Pedagogy
• Coordination
• Dynamical Systems Theory
• Perception-Action Coupling
• Soccer

Contact Information
Phone: 6790 3194
Email: jiayi.chow@nie.edu.sg
Office location: NIE 2-03-73
A Dynamical System Perspective to Understanding Badminton Singles Game Play


By altering the task constraints of cooperative and competitive game contexts in badminton, insights can be obtained from a dynamical systems perspective to investigate the underlying processes that result in either a gradual shift or transition of playing patterns. Positional data of three pairs of skilled female badminton players (average age 20.5 ± 1.38 years) were captured and analyzed. Local correlation coefficient, which provides information on the relationship of players’ displacement data, between each pair of players was computed for angle and distance from base position. Speed scalar product was in turn established from speed vectors of the players. The results revealed two patterns of playing behaviours (i.e., in-phase and anti-phase patterns) for movement displacement. Anti-phase relation was the dominant coupling pattern for speed scalar relationships among the pairs of players. Speed scalar product, as a collective variable, was different between cooperative and competitive plays with a greater variability in amplitude seen in competitive plays leading to a winning point. The findings from this study provide evidence for increasing stroke variability to perturb existing stable patterns of play and highlights the potential for speed scalar product to be a collective variable to distinguish different patterns of play (e.g., cooperative and competitive).

Nonlinear Learning Underpinning Pedagogy: Evidence, Challenges and Implications


This paper provides a brief overview of the framework of Nonlinear Pedagogy and evidence emanating from motor learning literature that underpins a nonlinear pedagogical approach. In addition, challenges for Nonlinear Pedagogy and a discussion on how Nonlinear Pedagogy support the work of Physical Education (PE) teachers will be shared. Evidence from the increasing volume of work on nonlinear learning from motor learning literature is used to suggest how acquisition of movement skills is supported by nonlinearity. The emergence of goal-directed behaviors is a consequence of the performer, environmental and task constraints. With a nonlinear pedagogy approach, the focus is on the individual learner where opportunities for meaningful actions can be learnt. Design principles based on representativeness, focus of attention, functional variability, manipulation of constraints and ensuring relevant information-movement couplings can be delivered via pedagogical channels of instructions, practices and feedback to the learners. Importantly, this focus on the individual sets the foundation for a developing nonlinear pedagogy framework to enhance teaching in PE although the challenges are non-trivial.
**Effects of External and Internal Focus Training on Foot-strike Patterns in Running**


The provision of instructions is an important task constraint when altering movement behaviours. Using instructions as a form of task constraint could be an effective approach to help learners improve their performances. Specifically, changing running gait from a heel to forefoot strike pattern can reduce incidences of injuries. By providing different attentional instructions, external and internal focus instructions, which emphasise movement effect and movement form respectively, can be used to alter foot strike patterns in running gait. The purpose of this study was to investigate the effectiveness of external or internal focus instructions in facilitating a change from a heel strike to a forefoot strike pattern. Sixteen participants (9 males, 7 females), were randomly assigned to either an external focus condition (n=8) or an internal focus condition (n=8). Participants underwent six training sessions with their respective instructional conditions over three weeks with 10 one-minute running trials per session during the intervention phase. A 3D motion analysis system was used to determine kinematic changes between pre and post-test sessions. Both external (0.025m ± 0.006) and internal (0.027m ± 0.008) participants showed a significant change in calcaneus displacement at initial contact (IC) by post-test, which indicates the change from heel strike to forefoot strike pattern. However, cycle time and stride length were not significantly different at post-test for participants in internal and external conditions. The effectiveness of both focus instructions could be task and individual dependent.

**Effect of analogy instructions with an internal focus on learning a complex motor skill**


An innovative learning design, nonlinear pedagogy, suggests that teachers or trainers should act as a facilitator in guiding a learner’s active exploration of the possibilities in a skill acquisition environment to enhance individual and adaptive learning within an ecological context. The purpose of this study was to examine the effects of a verbal instruction based on a nonlinear pedagogical approach to enhance exploration of movement solutions during complex motor skill acquisition. Two groups (n=12) of participants performed 20 lessons of breaststroke swimming with the goal to increase their swimming stroke length. Participants in the experimental condition received a verbal analogical instruction with an emphasis on internal focus of attention to guide participants’ learning. Analysis of inter-limb coordination showed qualitative changes leading to an increase in swimming efficiency for the experimental group compared to the control group. The findings from this study showed clearly that the use of analogy with an internal focus orientation, used as a macroscopic instruction about movement form, favors explorative learning that allows for an individualized optimal movement pattern to emerge.
The Effectiveness of Keeper-Independent Penalty Kicks using Fake Visual Cues from Penalty Takers


Previous research has shown that skilled football goalkeepers effectively utilised individualised visual search patterns to gather anticipatory cues from a penalty taker. Deceptive cues employed by a penalty taker induced lower save rates. However, it is unclear if goalkeeper visual search (percentage viewing time of areas of interest) differed between deceptive and non-deceptive conditions. This study investigated the effectiveness of using fake visual cues by the penalty taker, and corresponding visual search behaviours. Nine skilled goalkeepers simulated saves of 15 deceptive and 15 non-deceptive 2000ms clips by moving their hands left or right. Deception involved kicker’s gaze direction and approach angle. Deceptive trials had a lower percentage save rate. When two deceptive cues were combined, performance was further impaired. Available data for four participants showed individualised visual search patterns. In conclusion, using deceptive cues by a penalty taker is effective and individualised visual search behaviour was present.

“How does TGfU Work?”: Examining the Relationship between Learning Design in TGfU and A Nonlinear Pedagogy


In the last few decades, conceptions about teaching and learning in physical education have evolved from a teacher-centred approach to a more student-centred approach where learners are encouraged to develop problem-solving skills, critical thinking and autonomy of thought. A popular model advocating this approach in physical education, Teaching Games for Understanding (TGfU), has attracted widespread attention. Although advocates of TGfU have provided some empirical and anecdotal evidence to support the ‘tactical over technical approach’ to games teaching, recent work has highlighted that to date, the question ‘Does TGfU work?’ has remained largely unanswered. Therefore, there is a need to research the intuitive assumptions about how students learn to play games and to understand how the TGfU approach might work for games teaching and learning. The purpose of this paper is to provide insights to further our understanding of the possible processes underpinning the pedagogical principles of TGfU in games teaching. In this regard, we outline how a Nonlinear Pedagogy approach could provide a theoretical rationale to explain how the principles of TGfU might support learning design for games teaching. To achieve this aim, we examined the viability of the four key pedagogical principles of the TGfU model and highlighted the theoretical and practical implications of Nonlinear Pedagogy, considered with some empirical evidence from the motor learning literature. The theoretical ideas emanating from an ecological dynamics perspective, such as constraints manipulation, importance of maintaining information-movement coupling and harnessing movement variability, can underpin a Nonlinear Pedagogy approach. It has been proposed that research evidence from the motor learning literature can provide a suitable theoretical grounding to support the viability of the four main pedagogical principles of the TGfU model (i.e., sampling, tactical complexity, representation and exaggeration) and can contribute insights to the possible processes of TGfU in games teaching.
Focus of Attention as an Instructional Constraint on Movement Behavior


Investigations into the relative effectiveness of either focusing on movement form (Internal Focus) or movement effects (External Focus) have tended to dominate research on instructional constraints. However, rather than adopting a comparative approach to determine which focus of attention is more effective, analysis of the relative efficacy of each specific instruction focus during motor learning could be more relevant for both researchers and practitioners. Theoretical advances in the motor learning literature from a nonlinear dynamics perspective might explain the processes that underlie the effect of different attentional focus instructions. Referencing ideas and concepts from a current motor-learning model, differential effects of either Internal or External focus of instructions are examined. This paper also highlights some deficiencies in extant theory and research design on focus of attention which require further investigations.

Nonlinear Pedagogy: Learning Design for Self-Organizing Neurobiological Systems


In this paper, key concepts in ecological psychology and nonlinear dynamics exemplify how learning design can be shaped by ideas of self-organization, meta-stability and self-organized criticality in complex neurobiological systems. Through interactions with specific ecological constraints in learning environments, cognition, decision making and action emerge. An important design strategy is the use of different types of noise to channel the learning process into meta-stable regions of the “learner-learning environment” system to encourage adaptive behaviors. Here learners can be exposed to many functional and creative performance solutions during training. Data from studies in the performance context of sports are used to illustrate how these theoretical ideas can underpin learning design. Based on these insights a nonlinear pedagogy is proposed in which the role of coaches or trainers alters from a more traditional, prescriptive stance to the mode of manipulating key interacting task constraints including information, space and equipment to facilitate learning.
Coordination Changes in A Discrete Multi-articular Action as a Function of Practice


This study investigated how novices re-organized motor system degrees of freedom when practicing a multi-articular discrete kicking task. Four male participants practiced a soccer chipping task to seven different target positions over 12 sessions for 4 weeks. Data from each participant indicated changes in degrees of freedom involvement as a function of practice. Further, each participant showed a different progression of change in levels of joint involvement for hip, knee and ankle in the kicking limb. Cross-correlations between joints in the kicking limb also showed different pathways of coupling and de-coupling with practice. Performance outcome scores improved and variability of intra-limb coordination decreased as a consequence of practice for all participants. Angle–angle plots also showed qualitative changes in intra-limb coordination between early and late practice sessions. Evidence suggested that foot velocity at ball contact was functionally manipulated by participants when kicking to target positions with varying height and distance constraints. The present study highlighted individual differences in acquisition of coordination and control of joint motion even under similar task constraints, showing how degeneracy in movement systems facilitates learning.

The Role of Nonlinear Pedagogy in Physical Education


In physical education, the Teaching Games for Understanding (TGfU) pedagogical strategy has attracted significant attention from theoreticians and educators alike because it allows the development of game education through a tactic-to-skill approach based on the use of modified games. However, it has been proposed that, as an educational framework, it currently lacks adequate theoretical grounding from a motor learning perspective to empirically augment its’ perceived effectiveness by educators. In this paper we examine the literature base providing the theoretical underpinning for TGfU and explore the potential of a nonlinear pedagogical framework, based on Dynamical Systems Theory, as a suitable explanation for TGfU’s effectiveness as a strategy in physical education teaching. The basis of nonlinear pedagogy involves the manipulation of key task constraints on learners to facilitate the emergence of functional movement patterns and decision-making behaviors. We explain how interpretation of motor learning processes from a nonlinear pedagogical framework can underpin educational principles of TGfU and provide a theoretical rationale for guiding implementation of learning progressions in physical education.
SELECTED PUBLICATIONS

An Analysis of Activity Structures in Physical Education Classes 28

Culture, Embodied Experience and Teacher Development of TGfU in Australia and Singapore 28

Implications of Student Teachers’ Implementation of a Curricular Innovation 29

Implementing Teaching Games for Understanding: Stories of Change 29

‘In the Local Context’: Singaporean Challenges to Teaching Games on Practicum 30

TAN Kwang San, Steven Ph.D.

Current Appointments
Associate Professor
Deputy Divisional Director,
Office of Academic Administration and Services

Research Interest
• Professional Preparation
• Sport Pedagogy
• Curriculum Theory
• Outdoor Education

Contact Information
Phone: 6592 8211
Email: steven.tan@nie.edu.sg
Office location: NIE 1-01-01
The purpose of this study was to provide a descriptive analysis of the interactive events that occur in PE settings. Data for this study were drawn primarily from videotaped PE lessons across the different grade levels. A total of 35 videotaped lessons across 8 schools in 19 content areas were sampled for this study. The results of this study clearly indicated certain positive outcomes for PE teaching in Singapore schools. Primarily, PE teachers are task-oriented and focused on presenting curricular content to their students, and they do not appear to spend a lot of instructional time managing misbehaviours of their students in their PE classes. Furthermore, PE teachers do provide their students with numerous opportunities to learn and practice skills, concepts, teamwork and sportsmanship during practices and game plays, even though the percentage of class time ranges from only 7% to 14%.

Despite the diversity of cultural settings within which it is now being implemented, research on Teaching Games for Understanding (TGfU) is yet to address the impact of culture on teaching and learning. With its growth in Asia, in places such as Singapore and Hong Kong that are culturally distinct from western settings, this seems to be an area of research in need of attention in the TGfU literature. In setting out to redress this oversight in the literature this article draws on a study of TGfU teacher development conducted in Australia and Singapore to examine teachers’ development of TGfU/Games Concept Approach (GCA) teaching in a sequence covering the last two years of teacher education and the first two years of full-time teaching. This article highlights the extent to which teacher development of TGfU is situated within immediate cultural and institutional contexts. It identifies how the different cultural meanings attached to sport and its place in both countries shape the participants’ interpretation and understanding of TGfU/GCA.
Implications of Student Teachers' Implementation of a Curricular Innovation


This study examined 49 student teachers’ actions and perspectives when implementing a curricular innovation (the tactical games approach). Data were collected via videotaped lessons, interviews, and follow-up questionnaires. Questions for interviews and questionnaires were pilot tested and data were analyzed using the constant comparison method. Videotape analysis was facilitated by Noldus’s Observer (4.0) software and was tested for interobserver reliability. Results revealed that pupils were actively engaged for more than half (52%) of class time. The majority of student teachers’ questions were of low order (76%). The greatest challenges student teachers faced were pupils being new to the approach, or lacking skills. The greatest facilitators to implementing the tactical approach were physical education teacher education courses. Student teachers suggested that more opportunities to teach using the tactical approach in schools during methods classes would better prepare them for practicum. A follow-up questionnaire, one year later, determined that 87% of participants were still using the “innovation” in their teaching.

Implementing Teaching Games for Understanding: Stories of Change


Over the past decade, physical education has been inundated with different initiatives worldwide. In 2000, the Ministry of Education introduced a revised syllabus introducing the teaching of games-related concepts for the different games categories: territorial, net/wall, and striking/fielding. Corollary to this content framework is the promotion of the Teaching Games for Understanding pedagogy, which is considered most appropriate for achieving the stated aims and objectives identified in the new syllabus. The purpose of this paper was to investigate how teachers made sense of and experienced change as they attempted to successfully negotiate a new initiative mandated by the Ministry of Education. The unique stories of four teachers, which include their beliefs, rationales, decisions, and actions during the change process, are the major focus of this study.

This is an investigation of ‘situated learning’ among Singaporean physical education student teachers (STs) (n=11) who used a games concept approach (GCA) on their practicum in primary schools. Introduced to the physical education curriculum as part of a revised, mandated national syllabus, the GCA was reportedly having little impact ‘in the local context’ where PE had marginal status. Investigated were the extent to which the student teachers were able to use the GCA and their understanding of its challenges and facilitators. The practicum as an active apprenticeship in building ‘communities of [GCA] practice’ was central to the research methodology and findings. Data collected through interview (formative and summative), journals and field observations as well as a post-practicum group discussion were used to capture the background experiences, instructional practices and evaluation criteria used by the STs. The negotiated meanings of the GCA as structure, as product and as process are discussed in relation to issues encountered in its use (dealing with situational constraints, planning, questioning and sustaining pupil interest). Also discussed are STs' recommendations for GCA systemic implementation. Suggestions have been made for planning, teaching and structuring the school learning environment as well as for PETE programmes in order to constitute the GCA as effective in primary schools.
SELECTED PUBLICATIONS

Strategy for Creating Value in International Nongovernmental Sport Organisations: Good Governance, Autonomy, and Accountability

A Comparison of Physical Activity Among Primary, Secondary, and Junior College Students

Investing in Human Capital: Policy Leadership and Structural Alignment of Coach Education in Singapore

Perceptions of Parental Autonomy Support and Control, and Aspirations of Student Athletes in Singapore

CHEW Wai Cheong Eugene Ph.D.

Current Appointments
Assistant Professor
Coordinator, PESS PGDE (Primary & Secondary) Programme

Research Interest
- Motivation
- Parental Influence and Other Aspects of Interpersonal Influence

Contact Information
Phone: 6790 3699
Email: eugene.chew@nie.edu.sg
Office location: NIE 5-03-22
Strategy for Creating Value in International Nongovernmental Sport Organisations: Good Governance, Autonomy, and Accountability


Governance failures can easily wipe out whatever value organisations can accord to its stakeholders. On the other hand, organisations can preserve or create value by adopting a strategic approach to governing their organisations. Over the last decade, with increase governmental funding to sport development, greater attention is paid to governance of sport organisations within various nations. However, governance of international nongovernmental sport organisations is a less studied area. As the foremost international sport organisation, the International Olympic Committee (IOC) is the subject of this study in a brief analysis on how international nongovernmental organisations can preserve or create social value in accord with their missions and strategies by practicing good governance and applying the principles of autonomy and accountability. With the increased growth in activities and financial resources in the IOC, the demands for accountability become greater. The autonomy of the IOC becomes more significant with the increased complexity in the network of relationships that the IOC has with its constituents, partners, sponsors, beneficiaries, governments, and inter-governmental organisations. The applicability of the “strategic triangle” model is proposed as an organisational strategy for effective delivery of the social value by international nongovernmental organisations, and for handling the unwieldy task of balancing the autonomy of the IOC with its accountability to its stakeholders.

A Comparison of Physical Activity Among Primary, Secondary, and Junior College Students


The purpose of this study were to describe and analyze the physical activity patterns measured through pedometers among primary, secondary, and college students. A sample of 571 school children wore pedometers for 5 consecutive weekdays and one weekend day. Results showed that male students were more active than female students across all categories, except during co-curricular activity (CCA). Primary school students were more active compared to secondary school and college students. Taken together, the findings of the present study provide support that as children get older, the differences between the boys and girls reduced drastically and up to the college level, boys were equally inactive as the girls.

The Organisation for Economic Co-operation and Development (OECD) established that human capital development is one of the essential inputs that contribute significantly to the economic and human well-being of a nation. Investing in human capital is therefore a necessity for industry development and economic growth. The sports industry is an emerging industry sector. In Asia-Pacific market alone, experts projected a 29% growth in the sports market from US$13.7 billion in 2006 to US$17.7 billion in 2011. As Singapore positions itself to capture this potential market through the government’s support and investment in developing the sports sector mainly through infrastructure development and sports events programming, it is critical that adequate attention be paid to the development of human capital. Industry development requires more competent manpower in various disciplines. Sports coaching is an identified area for human capital to be developed. This chapter examines the policy and structural changes that affect coach education in Singapore. Together with an environmental scan of coach education in a few leading countries, it explores ways to provide more avenues as well as relevant approaches for professional development of coaches. The chapter concludes with a call for careful attention to be given to the following: (i) Leadership in national-level sports policy on coaching development and coach education; (ii) Alignment and synergy in sports policy and educational policy in supporting further development of human capital in the sports coaching; (iii) The role of tertiary educational institutions in providing avenues for professional development of coaches; and (iv) Further professional development of coaches in higher education.
Parents are significant others who exert strong influence on young adolescents. This study explores and examines the relationships between perceived parenting dimensions and various psychological-social variables; vis-à-vis basic psychological needs satisfaction, sport motivation, self-perceptions, and life aspirations of student athletes in Singapore. Two hundred and five student athletes (111 males and 94 females) aged 14 to 20 years old responded to the questionnaires. No gender differences were found. Both mother’s and father’s perceived parenting dimensions of involvement, autonomy support, and warmth correlated highly to student athletes’ satisfaction of basic psychological needs of relatedness, autonomy and competency. Comparison of these parenting dimensions showed that mother’s involvement and warmth were perceived to be higher than those of the father’s. Cluster analysis yielded three distinct groups with characteristic perceived parenting dimensions and psychological needs satisfaction. In comparison, Cluster 1 (labeled Cluster A-A) has average scores for parenting dimensions and psychological needs satisfaction for both parents. Cluster 2 (labeled Cluster L-L) has low scores while cluster 3 (labeled as Cluster H-H) has high scores for both sets of variables. The results from the analyses of the effect of the three clusters on the key variables showed that student athletes with high perceived parental involvement, autonomy support and warmth and reported that their basic psychological needs are highly met, when compared to the other two clusters, had significantly higher autonomous motivation, higher self-perceptions, and rated the importance of, and the likelihood of achieving, intrinsic aspirations higher. These findings are in congruence with the self-determination theory and supports previous studies’ findings that involved and autonomy-supportive parenting is linked to higher intrinsic aspirations.
SELECTED PUBLICATIONS

The Power of Now: Brief Mindfulness Induction Led to Increased Randomness of Clicking Sequence

Mindfulness, Movement Control and Attentional Focus Strategies: Effects of Mindfulness on a Postural Balance Task

Effects of Dispositional Mindfulness on the Self-controlled Learning of a Novel Motor Task

Relationships between Mindfulness, Flow Dispositions and Mental Skills Adoption: A Cluster Analytic Approach

KEE Ying Hwa, Adrian Ph.D.

Current Appointments
Assistant Professor
Coordinator, Higher Degree Programs

Research Interest
- Mindfulness and Flow
- Complex System Approach to Motor Control and Learning

Contact Information
Phone: 6790 3691
Email: yinghwa.kee@nie.edu.sg
Office location: NIE 5-03-30
The Power of Now: Brief Mindfulness Induction Led to Increased Randomness of Clicking Sequence


The capacity for random movement production is known to be limited in humans (e.g., Newell, Deutsch, & Morrison, 2000). We examined the effects of a brief mindfulness induction on random movement production because there are useful implications for variability in solving movement-related problems. The main task involved randomly clicking the 9 boxes in a $3 \times 3$ grid presented on a computer screen for five minutes. We characterized the sequence of clicking in terms of degrees of randomness, or periodicity, based on the fit, or probability, of the experimental data with its best fitting Bayesian network (4-click memory nodes) using the Markov chain Monte Carlo (MCMC) approach. Sixty-three participants were randomly assigned to either the experimental or the control condition. Mixed design repeated-measures ANOVA results show that the short mindfulness induction had a positive effect on the randomness of the sequence subsequently produced. This finding suggests that mindfulness may be a suitable strategy for increasing random movement behavior.

Mindfulness, Movement Control and Attentional Focus Strategies: Effects of Mindfulness on a Postural Balance Task


We examined whether the momentary induction of state mindfulness benefited subsequent balance performance, taking into consideration the effects of dispositional mindfulness. We also tested whether our mindfulness induction, grounded in sustaining moment-to-moment attention, influenced the attentional focus strategies that were adopted by the participants during the balancing task. Balance performance was ascertained based on approximate entropy (ApEn) of the center of pressure (COP) data. The study involved 32 males (age: $M = 22.8$, $SD = 1.94$) who were randomly assigned to the mindfulness or control group. Using difference in pretest to posttest performance based on the medio-lateral movements as the dependent variable, the test for interaction showed that the mindfulness induction was more effective for participants with higher dispositional mindfulness. Participants who underwent mindfulness induction also reported greater use of external focus strategies than those in the control group. Results suggest that momentary mindful attention could benefit balance performance and affect the use of attentional focus strategies during movement control.
Effects of Dispositional Mindfulness on the Self-controlled Learning of a Novel Motor Task


Current literature suggests that mindful learning is beneficial to learning but its links with motor learning is seldom examined. In the present study, we examine the effects of learners' mindfulness disposition on the self-controlled learning of a novel motor task. Thirty-two participants undertook five practice sessions, in addition to a pre-, post- and retention test. Choices of difficulty after each outcome were recorded. They also provided subjective assessment of enjoyment after the sessions. Results show that the high mindfulness group performed significantly better during pre- and post-tests, but no difference is found for retention test. The mindfulness group also tended to adopt adaptive strategies in their selection of difficulty. Finally, mean enjoyment scores among the high mindfulness group were significantly higher. The findings suggest that mindfulness may be a positive quality that can enhance the process of motor learning.

Relationships between Mindfulness, Flow Dispositions and Mental Skills Adoption: A Cluster Analytic Approach


This study examines the relationships between mindfulness, flow dispositions and mental skills adoption using the cluster analytic approach. Participants in this study were 182 university student athletes. They were administered the Mindfulness/Mindlessness Scale (MMS; Bodner, & Langer, 2001), Dispositional Flow Scale 2, DFS-2; Jackson, & Eklund, 2004) and Test of Performance Strategies (TOPS; Thomas, Murphy, & Hardy, 1999). Four distinctive mindfulness clusters were found based on their response on the MMS using cluster analysis. Marked differences in flow dispositions and mental skills adoption habits were observed between the high and the low mindfulness clusters. Those in the high mindfulness cluster scored significantly higher than the low mindfulness clusters in challenge–skill balance, merging of action and awareness, clear goals, concentration and loss of self-consciousness scores of the DFS-2. The high mindfulness clusters also scored significantly higher compared to the low mindfulness cluster in terms of attentional control, emotional control, goal setting and self-talk sub-scales of the TOPS. This study suggests that athletes’ flow dispositions and mental skills adoption could be differentiated using mindfulness. The findings have implications towards the understanding of flow and mental skills adoption within sport psychology.
SELECTED PUBLICATIONS

The Coaching Behavior Scale for Sport: Factor Structure Examination for Singaporean Youth Athletes

The Profile of Coaching and Coach Education in Singapore: Past, Present & Future

Experience in Competitive Youth Sport and Needs Satisfaction: The Singapore Story

Discriminating Factors between Successful and Unsuccessful Teams: A Case Study in Elite Youth Olympic Basketball Games

Developmental Pathways of Singapore’s High Performance Basketball Coaches

Examining the Ecological Validity of the Coaching Behavior Scale (Sports) for Basketball

Perceptions of Mentors on a Structured Mentoring Programme for Novice Coaches- A Case Study using Self-Determination Theory

The Creation and Implementation of a Formalized Mentoring Program for Novice Basketball Coaches

The Coaching Behaviour Scale for Sport: Factor Structure Examination for Singaporean Youth Athletes

Prosocial and Antisocial Behaviour in Sport Scale – A Validation Study

Current Appointments
Assistant Professor
Assistant Head (Graduate Programme), PESS

Research Interest
• Coaching
• Pedagogy
• Values and Characters Development
• Evaluation of Coaches’ Work
• Coach Education & Development
• Basketball

Contact Information
Phone: 6790 3696
Email: koonteck.koh@nie.edu.sg
Office location: NIE 5-03-25

The Coaching Behavior Scale for Sport (CBS-S) is designed to evaluate coaches’ involvement in developing athletes, taking into considerations the complex training and competition environment. Although CBS-S has been used in a number of empirical studies, the factor structure of the instrument has not been examined rigorously. The present study was, therefore, conducted to assess the factor structure of the CBS-S for Singaporean youth athletes. A total of 519 participants completed the CBS-S, and their responses were examined with confirmatory factor analysis (CFA) and recent exploratory structural equation modeling (ESEM). Both seven-factor CFA and ESEM models fit to the sample data adequately. In addition, the sizes of factor loadings on target factors were substantial and found comparable between the CFA and ESEM solutions. The findings from this study supported the factorial validity of the CBS-S for the present sample.


The demand for certified sports coaches in Singapore is high, especially from the schools and private sectors. This trend is in line with the significant global growth of the vocation of sports coaching (Taylor & Garratt, 2013). Singapore’s coaching landscape had undergone multiple changes in its short history having started only in the late 1970s. The foundation of the current coaching system was established in the late 1990s with the introduction of the National Accreditation Coaching Program (NCAP) and it is still the benchmark for the coaching practice in Singapore today. The basic NCAP is broken down to a theory and technical component which is administered by the Singapore Sports Council (SSC) and the National Sports Associations (NSAs) respectively. The SSC had embarked on various initiatives over the years to ensure that more Singaporeans have access to quality coaching. The purpose of this paper is to provide an informal review of the state of coaching and coach education in Singapore. The paper seeks to address three main themes: (1) provide an overview of the evolution of the Singaporean coaching system since the late 1990s, (2) describe examples of identified ground up initiatives from various stakeholders within the coaching ecosystem and (3) draw conclusions from existing literature and suggestions on how coach education systems can be further developed.
Experience in Competitive Youth Sport and Needs Satisfaction: The Singapore Story


The purpose of this study was to examine the relationship between sport experiences and psychological needs satisfaction of Singapore high school athletes who were involved in inter-school competition. A total of 1250 school athletes from 22 sports participated in the study. The athletes were between 13 and 18 years old and had an average of 3 years of experience in school sport (SD=.18). Cluster analysis was employed to identify homogenous groups based on the seven developmental experiences domains of the Youth Experience Survey (YES 2.0; Hansen & Larson, 2005). A one-way analysis of variance (ANOVA) was conducted to determine whether differences existed among the clusters in terms of psychological needs satisfaction (i.e., sense of autonomy, perceived competence and relatedness). The results of the cluster analysis showed that there were different subgroups of athletes with distinct developmental experiences, and they varied in the degree to which their psychological needs were satisfied. Generally, subgroups that had high levels of positive experiences and low levels of negative experiences in sport had better fulfillment of psychological needs. It is important to ensure that policies and programmes are formulated, delivered and monitored effectively to promote positive experiences for youth who are involved in competitive sports.

Discriminating Factors between Successful and Unsuccessful Teams: A Case Study in Elite Youth Olympic Basketball Games


Archival data was gathered from the FIBA33 games during the 1st inaugural Youth Olympic Games held in Singapore. Data collected from 70 basketball games played by boys from 20 participating countries were gathered for analysis. Analysis of game-related statistics and FIBA33 final rankings differentiated successful from unsuccessful teams. Ninety-five percent of the cases were correctly classified using discriminant analysis and in the cross-validation (leave-one-out method) the correct re-classification was 75 percent. Data triangulated from interviews and field notes were used to determine key factors contributing to team’s success in the FIBA33 games. Results of the present study showed that players from the top 10 successful teams could be differentiated from those in the bottom 10 unsuccessful teams. The determining factors were taller, had better shooting percentages, played aggressively (i.e., recorded more team fouls and the ability to draw fouls on opponents during games). Coaches can use these results to improve player’s recruitment process, reinforce the importance of fundamental skills such as shooting, individual offensive and defensive concepts under different game situations during trainings.

The purpose of this study was to examine the developmental pathways of high performance basketball coaches in Singapore. Such information is useful in providing information about appropriate training and development programmes for high performance coaches. Nine head coaches and assistant coaches from several senior and youth national basketball teams participated in structured retrospective quantitative interviews. All 6 coaches had at least a Level 2 coaching certificate (technical), with level 3 being the highest standard attainable in Singapore. They were experienced coaches at the 8 developmental level (i.e., school or club team) prior to their current appointment. Results are partially consistent with previous studies that: (1) most of the coaches were competitive athletes before coaching, and (2) coaches had engaged in coaching for at least ten years prior to coaching at the elite level. All participant coaches played a variety of sports in the early stages of sport participation. They also trained and prepared for structured competition from their early primary school days. Participant coaches also acknowledged the importance of informal and non-formal learning opportunities in enhancing their coaching knowledge and skills. Unique to the Singaporean context were the absence of mentoring, the structure of the sporting system, and the support for coach development through the national sporting organisation. The results are discussed in relation to coach education and coach development.


This study examined the key tasks of high-performance basketball coaches in Singapore using the Coach Behavior Scale for Sports (CBS-S). Seventeen participants (national coaches, team managers, players and other experts) took part in the study in which quantitative (CBS-S) and qualitative (semi-structured interviews) data were collected. The quantitative data were analysed using SPSS (Version 15.0) and the qualitative data were content analysed by three experienced researchers in sport psychology and coaching. The dimensions and items from the CBS-S were considered mostly relevant in evaluating the work of Singapore high-performance basketball coaches. However, some modifications were made to the CBS-S to make it more specific to the basketball context in Singapore based on conceptual, theoretical and empirical considerations. The final version of the Singapore CBS-S (Basketball) has 9 dimensions with 96 items as opposed to the original CBS-S with 7 dimensions and 70 items. Overall, the findings from this study were consistent with the literature on coaches’ work.
Perceptions of Mentors on a Structured Mentoring Programme for Novice Coaches - A Case Study Using Self-Determination Theory


The purpose of the study was to investigate the perceptions of the mentors involved in a formalised mentoring programme for novice basketball coaches, which was aimed at facilitating and promoting quality learning. Twelve mentors (1 female) were involved in this study. Self-determination theory (SDT) was used to frame a training package for mentors. Focused group interview was employed for all the mentors upon completion of the structured mentoring programme. Mentors reported that they benefited, such as the acquisition of mentoring knowledge and facilitation skills. The results provide support that SDT is a useful framework for training of effective mentors in delivering quality structured mentoring programme.

The Creation and Implementation of a Formalized Mentoring Program for Novice Basketball Coaches


The purpose of the current study was to develop and implement a formalized mentoring program for novice basketball coaches. Twelve purposefully selected mentors and 36 mentees who enrolled in an introductory coaching education course in Singapore participated in focus group interviews. Results indicated this program was a unique and positive learning experience for both the mentors and mentees. It helped the mentees become more competent and confident in their coaching style, knowledge, and behaviors. The program also enabled mentors to acquire useful pedagogical knowledge and skills, and to engage in meaningful self-reflection practices. All participants felt this program should be adopted by other sport associations in their country. Suggestions for improving the program were also forwarded.
The Coaching Behaviour Scale for Sport: Factor Structure Examination for Singaporean Youth Athletes


The Coaching Behavior Scale for Sport (CBS-S) is designed to evaluate coaches’ involvement in developing athletes, taking into considerations the complex training and competition environment. Although CBS-S has been used in a number of empirical studies, the factor structure of the instrument has not been examined rigorously. The present study was, therefore, conducted to assess the factor structure of the CBS-S for Singaporean youth athletes. A total of 519 participants completed the CBS-S, and their responses were examined with confirmatory factor analysis (CFA) and recent exploratory structural equation modeling (ESEM). Both seven-factor CFA and ESEM models fit to the sample data adequately. In addition, the sizes of factor loadings on target factors were substantial and found comparable between the CFA and ESEM solutions. The findings from this study supported the factorial validity of the CBS-S for the present sample.

Prosocial and Antisocial Behaviour in Sport Scale- A Validation Study


The purpose of the study was to examine the psychometric properties of the Prosocial and Antisocial Behavior in Sport Scale (PABSS) developed by Kavussanu and Boardley [13] to measure moral behaviors in Singapore’s context. A total of 574 (boys=296, girls=278) school team athletes were recruited for the study. Results showed that internal reliability, convergent validity and discriminant validity of the PABSS were supported. Evidence of configural, metric and scalar invariant of the PABSS across school and gender groups were also found in the present study. The findings suggest that the PABSS can be used to measure prosocial and antisocial behaviors among school athletes in Singapore.
SELECTED PUBLICATIONS

Modelling and Simulation in Springboard Diving 45

Association Between Foot Type and Lower Extremity Injuries: Systematic Literature Review With Meta-Analysis 46

Effects of Isometric and Dynamic Postactivation Potentiation Protocols on Maximal Sprint Performance 47

Reliability of Footprint Geometric and Plantar Loading Measurements in Children Using the Emed® M System 48

The Relationship between Physical Activity and Thermal Protective Clothing on Functional Balance in Firefighters 49

Unmatched Perception of Speed when Running Overground and On A Treadmill 49

Comparison of Longitudinal Biomechanical Adaptation to Shoes Degradation Between the Dominant and Non-Dominant Legs During Running 50

Hip Extension During the Come-Out of Multiple Forward and Inward Pike Somersaulting Dives is Controlled by Eccentric Contraction of the Hip Flexors 50

Bilateral Difference in Hamstrings to Quadriceps Ratio in Healthy Males and Females 51

Running in New and Worn Shoes: A Comparison of Three Types of Cushioning Footwear 51

KONG Pui Wah, Veni Ph.D.

Current Appointments
Assistant Professor
Assistant Head (Research), PESS
Time Table Committee

Research Interest
- Sport Biomechanics
- Computer Simulation Models
- Gait Analysis
- Gymnastics
- Diving
- Martial Arts

Contact Information
Phone: 6219 6213
Email: puiwah.kong@nie.edu.sg
Office location: NIE 5-03-32

This chapter summarised previous modelling and simulation research applied in springboard diving. Model features and study findings were discussed for each of the three key phases: 1) the takeoff from the springboard, 2) the diver in the airborne, and 3) the entry into the water. Insights into techniques such as the use of armswing, fulcrum setting, muscle activation pattern and optimal strategy to maximise dive height and angular momentum were provided.

**Study Design:** Systematic literature review with meta-analysis. **Objectives:** To investigate the association between non-neutral foot types (high arch and flat foot) and lower extremity and low back injuries, and to identify the most appropriate methods to use for foot classification. **Methods:** A search of 5 electronic databases (PubMed, EMBASE, CINAHL, SPORTDiscus, and ProQuest Dissertation and Thesis), Google Scholar, and reference lists of included studies was conducted to identify relevant articles. The review included comparative cross-sectional, case control, and prospective studies that reported qualitative/quantitative associations between foot types and lower extremity and back injuries. Quality of the selected studies was evaluated and data synthesis for the level of association between foot types and injuries was conducted. A random-effects model was used to pool odds ratios (OR) and standardized mean differences (SMD) results for meta-analysis. **Results:** Twenty-nine studies were selected and included for meta-analysis. A significant association between non-neutral foot types and lower extremity injuries was determined [OR (95% confidence intervals (CI) = 1.23 (1.11, 1.37); p < .001]. Foot posture index (FPI) [OR = 2.58 (1.33, 5.02); p < .01] and visual/physical examination [OR = 1.17 (1.06, 1.28); p < .01] were 2 assessment methods using distinct foot type categories that displayed significant association with lower extremity injuries. For foot assessment methods using a continuous scale, measurements of Lateral Calcaneal Pitch Angle [SMD = 1.92 (1.44, 2.39); p < .00001], Lateral Talo-Calcaneal Angle [SMD = 1.36 (0.93, 1.80); p < .00001], and Navicular Height (NH) [SMD = 0.34 (0.16, 0.52); p < .001] displayed significant effect sizes in identifying high arch foot, while Navicular Drop Test [SMD = 0.45 (0.03, 0.87); p < .05] and Relaxed Calcaneal Stance Position [SMD = 0.49 (0.01, 0.97); p < .05] for flat foot. Subgroup analyses revealed no significant associations for children with flat foot, cross-sectional studies, or prospective studies on high arch. **Conclusion:** High arch and flat-foot foot types are associated with lower extremity injuries but the strength of this relationship is low. Although FPI and visual/physical examination are methods that displayed significance, they are qualitative measures. Radiographic and NH measurements can delineate high arch foot effectively, with only anthropometric measures accurately classifying flat foot. **Level of Evidence:** Prognosis, level 1b.
This study examined the effects of 3 types of post-activation potentiation (PAP) protocols (single joint isometric, multi-joint isometric and multi-joint dynamic) on subsequent 10-, 20- and 30-meter sprint performance in 12 well-trained male track athletes (mean ± SD age = 22.4 ± 3.2 years). The subjects performed four protocols in a randomized order on different days: control (4 minutes of passive rest), maximum voluntary isometric knee extension (3 repetitions of 3-seconds isometric knee extension), maximum voluntary isometric back squat (3 repetitions of 3-seconds isometric squat) and dynamic back squat (3 repetitions of back squats at 90% 1 repetition maximum). After each protocol, a 4-minute recovery period was incorporated prior to a 30-meter maximal sprint assessment. Maximal sprint times at 10-, 20- and 30-meter were measured using timing gates to reflect sprint performance. One-way repeated measures Analyses of Variance revealed no differences in sprint performance among the four protocols at 10-, 20- or 30-meter intervals. There were, however, large individual variations in the response to the PAP protocols with some athletes benefiting from the PAP effect and others not. In summary, this study showed no enhancement of short-distance sprint performance after PAP protocols with a 4-minute recovery period, regardless of isometric or dynamics, single-joint or multi-joint. Coaches considering the use of PAP protocols to improve sprinting performance of their athletes should exploit the effectiveness of different PAP protocols on an individual basis.
This study investigated the between-day reliability of footprint geometric and plantar loading measurements on children utilising the Emed® M pressure measurement device. Bilateral footprints (static and dynamic) and foot loading measurements using the two-step gait method were collected on 21 children two days apart (age = 9.9 ± 1.8 years; mass = 34.6 ± 8.9 kg; height = 1.38 ± 0.12 m). Static and dynamic footprint geometric (lengths, widths and angles) and dynamic loading (pressures, forces, contact areas and contact time) parameters were compared. Intraclass correlation coefficients of static geometric parameters were varied (0.19-0.96), while superior results were achieved with dynamic geometric (0.66-0.98) and loading variables (0.52-0.94), with the exception of left contact time (0.37). Standard error of measurement recorded small absolute disparity for all geometric (length = 0.1-0.3 cm; arch index = 0.00-0.01; subarch angle = 0.6-6.2°; left/right foot progression angle = 0.5°/0.7°) and loading (peak pressure = 2.3-16.2 kPa; maximum force = 0.3-3.0%; total contact area = 0.28-0.49 cm²; % contact area = 0.1-0.6%; contact time = 32-79 ms) variables. Coefficient of variation displayed widest spread for static geometry (1.1-27.6%) followed by dynamic geometry (0.8-22.5%) and smallest spread for loading (1.3-16.8%) parameters. Limits of agreement (95%) were narrower in dynamic than static geometric parameters. Overall, the reliability of most dynamic geometric and loading parameters was good and excellent. Static electronic footprint measurements on children are not recommended due to their light body mass which results in incomplete footprints.
**The Relationship between Physical Activity and Thermal Protective Clothing on Functional Balance in Firefighters**


We investigated the relationship between baseline physical training and the use of firefighting thermal protective clothing (TPC) with breathing apparatus on functional balance. Twenty-three male firefighters performed a functional balance test under four gear/clothing conditions. Participants were divided into groups by physical training status, and task performance was analyzed. There was an effect of equipment and training status on performance with the group reporting both aerobic and resistance training performing better than the group reporting no physical training. In conclusion, firefighters walk more slowly as a strategy to maintain balance when wearing TPC, which may be suboptimal given the emergent nature of fire suppression. This result was most prominent in the group reporting no physical training.

**Unmatched Perception of Speed when Running Overground and On A Treadmill**


This study compared the perception of speed between overground and treadmill running. Twenty-one participants ran overground around an athletic track at their preferred speed for 3 min, immediately followed by a 3-min treadmill run and a further 3-min overground run. During the treadmill run, participants were blinded to the speed display and were free to adjust the speed until it was perceived similar as their previous self-selected overground speed. A video camera was used to determine the average running speed during each overground run. A one-way ANOVA with repeated measures was used to detect differences among the three speeds: overground speed during session 1 (OG1), perceived overground speed on the treadmill (TM), and overground speed during session 2 (OG2). A significant difference among the three running speeds was found (P=.039). Post hoc analyses showed that the treadmill speed was much slower than both overground speeds but the overground speed did not differ between session 1 and session 2 (OG1: 3.99 (0.78) m/s, TM: 2.73 (0.62) m/s, OG2: 3.80 (0.74) m/s). These findings confirmed that one's perception of speed was influenced by the treadmill on which individuals were unable to match their corresponding self-selected overground running speed. The unmatched perception of speed is likely due to the distortion of normal visual inputs resulting from the discrepancy between observed and expected optic flow. Clinicians, therapists and treadmill users should be aware of the different psychological demands between treadmill and overground locomotion when selecting gait speed.

This study compared the biomechanical adaptation to running shoe degradation between the dominant (D) and non-dominant (ND) leg. Twenty-four runners performed a pre-test in the laboratory, completed 200 miles of road running in a pair of assigned shoes and then returned for a post-test. Kinetic and kinematic data of running in new and worn shoes were collected. Repeated measures ANOVA (Shoe×Leg) were used to analyze temporal, kinetic and kinematic variables (α=.05). A symmetry index (SI) was calculated for the temporal and kinetic variables and paired t-tests were used to compare the SI between shoe conditions. Stance time increased by approximately 7 ms in worn shoes (p= .027). Bilateral differences in the kinematic change (Shoe×Leg interaction) were seen in the torso (p<.05), knee (p<.05), marginally at the hip (p<.10) but not the ankle. No difference in kinetic variables or SI was observed. When running in worn shoes, the torso displayed reduced forward lean for both sides and to a greater extent during the D leg strike. The D hip and knee showed a more extended position for the worn shoe condition while an increased flexion was observed in the ND leg. Most of the kinematic differences observed were small and within the intra-subject variability measured during the same session. Future studies may consider performing a three-dimensional analysis at a higher sample rate and further explore whether asymmetrical adaptation is related to running injuries.


A modelling approach was used in the present study to investigate the role of the hip muscles during the come-out of forward and inward multiple somersaulting dives in a pike position. A planar two-segment model was used to simulate the somersault and come-out of three commonly performed dives from a 3-m springboard: forward two-and-one-half somersault pike dive (105B), forward three-and-one-half somersault pike dive (107B), and inward two-and-one-half somersault pike dive (405B). Three simulations were run for each dive: (1) hip angle was constrained to be constant, (2) hip torque was removed after 0.1 s, and (3) hip angle was constrained to a typical come-out time history used by elite divers. Simulation results indicated that hip flexion torque was required both to maintain a rigid pike position during somersault (range = 205.5-282.3 Nm) and to control the hip extension movement during the come-out (peak torque range = 355.8-548.1 Nm) in forward and inward multiple somersaulting dives. Coaches and divers should be aware that dry-land exercise drills producing hip extension movement by concentric actions of the hip extensor muscles do not replicate the neuromuscular control during the come-out of fast rotating dives.
**Bilateral Difference in Hamstrings to Quadriceps Ratio in Healthy Males and Females**


**Objective:** To compare the isometric and isokinetic hamstrings to quadriceps (H:Q) ratio 1) between the dominant (D) and non-dominant (ND) legs, and 2) between healthy males and females. **Design:** Cross-sectional. **Setting:** University research laboratory. Quadriceps and hamstrings strength were assessed by maximum isometric contractions at six angles (40 degrees, 50 degrees, 60 degrees, 70 degrees, 80 degrees, 90 degrees) and concentric contractions at three angular velocities (60 degrees s(-1), 180 degrees s(-1), 300 degrees s(-1)). **Participants:** Forty physically active adults (25 males).

**Main Outcome Measures:** Peak isometric and isokinetic torques of the quadriceps and hamstrings, and the corresponding H:Q ratios. **Results:** Isometric H:Q ratio increased with greater knee extension (P<0.001), with overall a higher ratio in the D leg (P<0.001). Isokinetic H:Q ratio increased with angular velocity (P<0.001), with a higher ratio in the D leg (P<0.05). Neither isometric nor isokinetic H:Q ratios differed between males and females. **Conclusions:** When setting rehabilitation goals, it may be appropriate to adjust the H:Q ratio and leg strength based on the uninvolved leg with consideration of leg dominance. Gender-related differences do not explain the discrepancy in the literature regarding bilateral differences in the H:Q ratio. Other subject characteristics such as age and training may be more relevant.

**Running in New and Worn Shoes: A Comparison of Three Types of Cushioning Footwear**


**Objectives:** In this study, the effect of shoe degradation on running biomechanics by comparing the kinetics and kinematics of running in new and worn shoes was investigated. Three types of footwear using different cushioning technologies were compared. **Design:** Longitudinal study. **Setting:** Pre- and post-tests on overground running at 4.5 m s(-1) on a 20-m laboratory runway; performance measured using a force platform and a motion capture system. **Participants:** 24 runners (14 men and 10 women). **Interventions:** 200 miles of road running in the same pair of shoes. **Main Outcome Measures:** Stance time was calculated from force data. External loads were measured by maximum vertical force and loading rate. Kinematic changes were indicated by sagittal plane angles of the torso, hip, knee and ankle at critical events during the stance phase. **Results:** Stance time increased (p=0.035) in worn shoes. The torso displayed less maximum forward lean (p<0.001) and less forward lean at toe-off (p<0.001), while the ankle displayed reduced maximum dorsiflexion (p=0.013) and increased plantar flexion at toe-off (p<0.001) in worn shoes. No changes in the hip and knee angles. No between-group difference among the three footwear groups or condition by type interaction was found in any measured variables. **Conclusions:** As shoe cushioning capability decreases, runners modify their patterns to maintain constant external loads. The adaptation strategies to shoe degradation were unaffected by different cushioning technologies, suggesting runners should choose shoes for reasons other than cushioning technology.
SELECTED PUBLICATIONS

Methodological Issues in Using Data from Social Networking Sites

Make Me Proud! Singapore 2010 Youth Olympic Games and Its Effect on National Pride of Young Singaporeans

LENG Ho Keat
Ph.D.

Current Appointments
Assistant Professor
Coordinator, PESS BSc Programme

Research Interest
• Sport Retailing
• Sport Marketing
• Perceptions of Sport
• Assessment in Education

Contact Information
Phone: 6790 3697
Email: hokeat.leng@nie.edu.sg
Office location: NIE 5-03-24
Methodological Issues in Using Data from Social Networking Sites


Social networking sites (SNS) have become increasingly popular in recent years. With the amount of data available on SNS, the potential exists for researchers to use these data for their research. However, like any research method, there are limitations in using data from SNS. First, as members of SNS are not representative of the population, there is the limitation in generalizing the findings to the population. Second, in SNS with a low level of activity, there is also the issue of whether the data are sufficient for analysis. Third, the validity of the postings by members of SNS should be considered, as members of SNS may not be truthful in their responses. In addition, as the environment for SNS favors a quick emotive response as opposed to a cognitive response, the review suggests that the researcher will need to be aware of possibly different behavior when members of a SNS are faced with a high involvement decision. This article concludes that while there is potential in analyzing data from SNS, researchers should be aware of the limitations in using these data.

Make Me Proud! Singapore 2010 Youth Olympic Games and Its Effect on National Pride of Young Singaporeans


Politicians and sports organizations have often relied on economic benefits to justify their decisions in hosting major sports events in their countries. Consequently, there are comparatively few studies on the non-economic benefits of hosting major sports events. The purpose of this research is to determine whether there is any change in the level of national pride in the hosting of the Youth Olympics Games held recently in Singapore in 2010. Two separate surveys were conducted among students from a tertiary education institution in Singapore two months prior to, and after, the event. Results showed a significant increase in the level of national pride. Specifically, the increases in the level of national pride were more pronounced among males and those who were more involved in sports. The results concur with previous studies that have reported an increase in national pride following the hosting of a major sports event. As this is a case study focusing on the Youth Olympic Games, which arguably is on a distinctly smaller scale compared to the Olympics or the FIFA World Cup, future research needs to be conducted on other major sports events to determine the generalizability of the findings.
SELECTED PUBLICATIONS

Longitudinal Changes in Physical Fitness Performance in Youth: A Multilevel Latent Growth Curve Modeling Approach 55

College students’ motivation and learning strategies profiles and academic achievement: A self-determination theory approach 55

A latent profile analysis of sedentary and physical activity patterns among Singaporean students 56

Influence of Perceived Motivational Climate on Achievement Goals in Physical Education: A Structural Equation Mixture Modeling 56

Chinese students’ motivation in physical activity: Goal profile analysis using the traditional achievement goal theory 57

Perceived autonomy support, behavioural regulations in physical education and physical activity intention 57

Moving towards quality physical education: Physical education provision in Singapore 58

Students' attitudes and perceived purposes of physical education in Singapore: Perspectives from a 2 x 2 achievement goal framework 59
**Longitudinal Changes in Physical Fitness Performance in Youth: A Multilevel Latent Growth Curve Modeling Approach**


Using a multilevel latent growth curve modeling (LGCM) approach, this study examined longitudinal change in levels of physical fitness performance over time (i.e. four years) in young adolescents aged from 12–13 years. The sample consisted of 6622 students from 138 secondary schools in Singapore. Initial analyses found between-school variation on fitness test scores with intra-class correlations ranging from 0.02–0.19. Subsequent multilevel growth curve analyses revealed a quadratic trend of the longitudinal data across five stations of performance tests, with significant within-school student variability in change over time. The result of the multilevel LGCM showed that there were strong school effects on all of the physical fitness performances, in addition to inter- and intra-individual differences.

*Keywords*: Multilevel latent growth curve, longitudinal change, fitness tracking, fitness testing, latent growth curve modeling

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**College Students’ Motivation and Learning Strategies Profiles and Academic Achievement: A Self-Determination Theory Approach**


The development of effective self-regulated learning strategies is of interest to educationalists. In this paper, we examine inherent individual difference in self-regulated learning based on Motivated Learning for Learning Questionnaire (MLSQ) using the cluster analytic approach and examine cluster difference in terms of self-determination theory related variables. The sample of the study consisted of 238 junior college students from 12 intact classes. Two adaptive clusters and two maladaptive clusters were uncovered based on the MLSQ, with the adaptive clusters showing better academic grades. Results from the one-way MANOVA showed that the four clusters differed significantly in terms of their needs satisfaction, behavioural regulations, enjoyment, effort and value. The findings supported the importance of needs satisfaction in the development of self-regulated learning behaviour.

*Keywords*: autonomy-supportive, self-regulated learning, cluster analysis, needs satisfaction, learning styles
A Latent Profile Analysis of Sedentary and Physical Activity Patterns Among Singaporean Students


**Aim** The aim of the current study was to examine the physical activity and sedentary behavioral patterns of children and adolescents using the model-based latent profile analysis (LPA) approach. **Subject and methods** A sample of 847 school children aged 10 to 16 years from 28 Singapore schools took part in the study. Physical activity and sedentary behavior were assessed using a 7-day physical activity recall questionnaire. **Results** The findings of the present study showed that there were at least five groups of students with unique sedentary and physical activity patterns. A few clusters were gender-specific. For example, groups 1 and 4 were female-dominated clusters and group 3 was male-dominated. The younger children in the primary school had different sedentary and physical activity behaviors. **Conclusions** This study demonstrates the use of LPA to group individuals into homogenous groupings in order to help researchers make informed decisions about the number of underlying groupings. This can have benefits for targeting specific groups in interventions.

Influence of Perceived Motivational Climate on Achievement Goals in Physical Education: A Structural Equation Mixture Modeling


The purpose of the current study was to examine the influence of perceived motivational climate on achievement goals in Physical Education (PE) using a structural equation mixture modelling (SEMM) analysis. Within one analysis, we identified groups of students with homogenous profiles in perceptions of motivational climate and examined the relationships between motivational climate, 2 x 2 achievement goals and affect, concurrently. The findings of the present study showed that there were at least two distinct groups of students with differing perceptions of motivational climate, one group of students had much higher perceptions in both climates compared to the other group. Regardless of their grouping, the relationships between motivational climate, achievement goals, and enjoyment seemed to be invariant. Mastery climate predicted the adoption of mastery-approach and mastery-avoidance goals, performance climate were related to performance-approach and performance-avoidance goals. Mastery-approach goal had a strong positive effect while performance-avoidance had a small negative effect on enjoyment. Overall, it was concluded that only perception of a mastery motivational climate in physical education may foster intrinsic interest in PE through adoption of mastery-approach goals.

**Keywords**: Achievement goals, motivational climate, latent profile analysis, SEM mixture model
Chinese Students' Motivation in Physical Activity: Goal Profile Analysis Using the Traditional Achievement Goal Theory


One of the contributing factors for the increased obesity rate in China is the reduction of physical activity and exercise. With this as the backdrop, understanding Chinese students’ motivation toward physical education (PE) and physical activity is a worthy area of study. The purpose of this study was to examine Chinese students’ motivation for physical activity using the achievement goal approach. A total of 984 Chinese students from six schools in mainland China participated in the survey measuring achievement goals, motivational regulation, perceived competence, attitudes toward PE, and physical activity. Using cluster analysis, four goal profiles were found. Three clusters were similar to the ‘highly motivated,’ ‘moderately motivated,’ and ‘lowly motivated’ clusters found in previous study (Wang, Chatzisarantis, Spray, & Biddle, 2002). One additional cluster with a ‘moderate task/moderate ego/high perceived competence’ goal profile (Cluster 2) consisted of 39.6% of the sample and was unique to the Chinese sample. This cluster was found to have the lowest external regulation and high identified regulation and intrinsic motivation; they also had the most positive attitudes toward PE and reported highest participation in physical activity. There were gender differences among the four goal profiles. The majority of the Chinese students did not have an ideal goal profile adaptive for long term motivation. Therefore, there is a need for intervention to increase the task orientation and perceived competence of Chinese students in PE.

*Keywords*: achievement goal profile, cluster analysis, motivation

Perceived Autonomy Support, Behavioural Regulations in Physical Education and Physical Activity Intention


**Objectives** The purpose of this study was to examine the relationships between students' perceived autonomy support, behavioural regulations and their intentions to be physically active outside of school. **Method** Participants were 701 secondary school students aged between 13 and 17 years from Singapore. Questionnaires were used to assess perceived autonomy support, behavioural regulation, and intentions to be physically active outside school. **Results** Results supported the hypothesised model in that perceived autonomy support fosters more self-determined forms of behavioural regulations in PE. These forms of behavioural regulations in turn, enhanced more autonomous forms of intentions. The results also yielded an interesting finding that amotivation positively predicted students' intention to be physically active outside school. **Conclusion** The findings highlight the importance of perceived autonomy support in fostering more self-determined forms of behavioural regulations in PE and intention to be physically active outside school.

*Keywords*: Physical education, Self-determination theory, Perceived autonomy support, Behavioural regulations, Physical activity intention
This study investigated the provision of physical education (PE) in Singapore. Singapore is a small island city state of approximately 699 square kilometres with a population of about 4 million people. This article aims to highlight the current status of PE in Singapore schools and compare it against suggested international standards and recommendations. From questionnaires distributed to every school on a voluntary basis, 164 Heads of Department (HODs) from 78 primary schools, 74 secondary schools and 12 junior colleges, and 474 teachers from 170 schools responded. The findings from these questionnaires focused on the impact of facilities, staffing, timetabling, curriculum time and status, on the provision of PE. In relation to the international context, Singapore faces similar constraints such as inadequate facilities and equipment, and insufficient allocation of time. The study makes a strong case for the improved status and function of PE in schools but three main issues require further attention: (i) primary schools are disadvantaged by staffing issues and general provision; (ii) PE lessons are both inadequate in number and duration to achieve the ‘desired outcomes’ of the PE syllabus; and (iii) class sizes are considered too large for meaningful learning to occur, resulting in teachers prioritising management issues. When these issues are addressed and their solutions translated into practice, Singapore can actualise the vision of making every student physically educated and achieve a world class standard.

Keywords: physical education, provision of physical education, views and experiences

The aim of the present study was to re-examine the relationships between achievement goals and perceived purposes of PE, perceived motivational climates, attitudes towards PE teachers and affective outcomes using the 2 x 2 achievement goal framework. Questionnaires were completed by 493 secondary school students (222 males, 262 females, 9 missing) in Singapore. Cluster analysis revealed three distinct clusters that differed significantly in their achievement goals profiles. One cluster consisting of high scores on mastery approach, mastery avoidance and performance avoidance achievement goals was linked to the most positive set of characteristics and outcomes, while the cluster with low achievement goals was linked to most negative characteristics and outcomes. There was another cluster with moderate levels of mastery approach that had relatively positive perceptions and attitudes towards PE. The findings of these three goal profiles provide insight and add knowledge to the existing literature. Research that ignores the independence of the 2 x 2 achievement goal framework may risk making spurious conclusions.

*Keywords:* Physical education, student attitudes, academic achievement, multivariate analysis, foreign countries, secondary school students, student motivation, achievement need, questionnaires, educational objectives, competence, mastery learning, student evaluation of teacher performance, gender differences
SELECTED PUBLICATIONS

Examining Discriminant Validity Issues of the Sport Motivation Scale-6 61

When Effects of Universal Needs on Health Behaviour Extend to a Large Proportion of Individuals 61

Interpreting the Dispositional Flow Scale-2 Scores: A Pilot Study of Latent Class Factor Analysis 62

Flow Experience in Physical Activity: Examination of the Internal Structure of Flow from a Process-Related Perspective 62

The Flow State Scale-2 and Dispositional Flow Scale-2: Examination of Factorial Validity and Reliability for Japanese Adults 63

Progressing Measurement in Sport Motivation with the SMS-6: A Response to Pelletier, Vallerand, and Sarrazin 64

The Sport Motivation Scale-6 (SMS-6): A Revised Six-Factor Sport Motivation Scale 64

Current Appointments
Assistant Professor
Coordinator, Conferences and Seminar

Research Interest
- Exercise and Sport Psychology
- Engagement
- Measurement
- Optimal Functioning
- Physical Activity Promotion
- Positive Human Development

Contact Information
Phone: 6790 3702
Email: masato.kawabata@nie.edu.sg
Office location: NIE 5-03-20
Examining Discriminant Validity Issues of the Sport Motivation Scale-6


The current study was conducted to re-assess the factor structure of the 24-item Sport Motivation Scale-6 (SMS-6; Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007) with an independent sample. A total of 437 participants completed the SMS-6, and their responses were examined with confirmatory factor analysis and recent exploratory structural equation modelling (Asparouhov & Muthén, 2009). A six-factor confirmatory-factor-analysis model did not fit to the sample data adequately. Through examination of the corresponding exploratory-structural-equation-modelling solution, it was found that two items loaded on non-target factors poorly. This result was replicated by a published data set (Mallett et al., 2007). The modified confirmatory-factor-analysis model with these two items removed fit to the present study’s data satisfactorily and all six factors were adequately differentiated. These results generally validate the SMS-6 responses. Furthermore, this study demonstrated the usefulness of a comparison of confirmatory-factor-analysis and exploratory-structural-equation-modelling solutions for an accurate interpretation of individual parameters.

When Effects of Universal Needs on Health Behaviour Extend to a Large Proportion of Individuals


Based on tenets of self-determination theory, the present manuscript examined the hypothesis that a physical activity intervention program that supported the universal psychological need for autonomy would motivate a large proportion of young individuals to engage in physical activity. In contrast, we hypothesised that interventions that did not support the universal psychological need for autonomy would motivate a smaller proportion of young individuals to endorse the physical activity program. A field experiment was conducted. Participants were randomly allocated to an intervention that supported the psychological need for autonomy and two conditions that did not support the psychological need for autonomy (rationale-only or forced-choice conditions). It was demonstrated that more young individuals initiated and completed a physical activity intervention program when the program supported the psychological need for autonomy than when the program did not support the psychological need for autonomy. Results of the present study provide additional evidence to a growing body of literature recognising the importance of universal psychological needs in motivating health-related behaviours.
Interpreting the Dispositional Flow Scale-2 Scores: A Pilot Study of Latent Class Factor Analysis


The present study examined the extent to which scores on the Dispositional Flow Scale-2 (DFS-2) could differentiate individuals who frequently experience flow characteristics in physical activity from those who do not. A total of 993 participants completed the Japanese version of the DFS-2. Latent class factor analysis (LCFA), which combines the strengths of both latent class analysis and factor analysis, was conducted on the DFS-2 responses. Six classes were identified through a series of LCFA and the patterns of the item-average scores for the nine flow attributes were found to be parallel among these classes. The top two and bottom two classes (19.3% and 13.4% of the whole sample) were considered the groups who experience flow characteristics frequently and seldom, respectively. These results indicated that individuals who often experience flow attributes in physical activity could be differentiated from those who do not based on their DFS-2 scores.

Flow Experience in Physical Activity: Examination of the Internal Structure of Flow from a Process-Related Perspective


Considering the phenomenology of flow experience reflects attentional processes, Nakamura and Csikszentmihalyi (2002) classified the components of flow experience into proximal conditions and the characteristics of a subjective state while being in flow. The present study was conducted to clarify the concept of flow through examination of the interrelationships among the components from a process-related perspective. A total of 1,048 participants completed the Japanese versions of the Flow State Scale-2 (Kawabata, Mallett, & Jackson, 2008), and based on their scores, 591 respondents were considered to be in a flow state during their physical activity. A proposed higher-order confirmatory factor model and a full structural equation model were tested for the flow respondents. The results of the higher-order model indicated that the 9 flow factors were empirically classified into the flow state and its proximal condition. Furthermore, the outcomes of the full structural model preliminarily supported the hypothesized sequential relationships among flow factors.

The primary purpose of this study was to examine the factorial validity and reliability of the Japanese versions of the Flow State Scale-2 and Dispositional Flow Scale-2 (JFSS-2 and JDFS-2) for use with Japanese adults. To accomplish the aim, a multi-staged approach was employed. Following the guidelines for test adaptation (Tanzer & Sim, 1999), the two flow scales were translated from English to Japanese and the best 36 items for each instrument was identified through two pilot studies. Employing a 9-factor 1st-order hypothesized model, the factorial validity of the JFSS-2 and JDFS-2 was tested and cross-validated with confirmatory factor analysis (CFA). In addition to internal consistency reliability for the both scales, stability was assessed over a 4-week time period for the JDFS-2. Furthermore, measurement equivalence was examined across Japanese independent samples as well as two cultural samples. The results of a series of CFAs revealed that the data for the JFSS-2 and JDFS-2 were represented appropriately by the hypothesized 1st-order model. For the both scales, internal consistency estimates for all factors were satisfactory, whereas the stability of single factors over time were medium to high. Measurement invariance was established across the Japanese samples as well as the cultural samples. The findings from this study provided strong support for the validity and reliability of the JFSS-2 and JDFS-2 in assessing flow experiences in physical activity for Japanese adults. In addition, this study indicated that the Japanese versions of the flow scales are useful instruments for cross-cultural research.
Progressing Measurement in Sport Motivation with the SMS-6: A Response to Pelletier, Vallerand, and Sarrazin


Measurement in sport psychology is a major issue and attempts to progress measurement should be valued and encouraged. Construct validation is an ongoing process (Marsh, & Jackson, 1999) and the publication of the SMS-6 (Mallett, Kawabata, Newcombe, Otero-Ferero, & Jackson, 2007) was an attempt to progress measurement in contextual sport motivation using self-determination theory (SDT, Deci, & Ryan, 1985). Mallett et al. argued for the need to re-develop the Sport Motivation Scale (SMS, Pelletier, et al., 1995) primarily because the SMS did not measure integrated regulation, and secondly due to consistently reported problems with the lack of convergent and discriminant validity. Pelletier, Vallerand, and Sarrazin’s (2007) commentary on the SMS-6, focused on two legitimate questions: “Does the SMS need to be revised?”, and “Is the revised 6-factor SMS a better scale?” In addressing the first question, this article provides strong evidence that supports the arguments that the SMS does need revision. In addressing the second question, we provided sound arguments for the development of the SMS-6. However, we concluded that the superiority of the SMS-6 in measuring contextual sport motivation across diverse age and cultural groups is a question for future and continuing research. Further examination of the SMS-6 is necessary before such claims can be endorsed.

The Sport Motivation Scale-6 (SMS-6): A Revised Six-Factor Sport Motivation Scale


The sport motivation scale (SMS; Pelletier, et al., 1995) was developed to measure an athlete's motivation toward sport participation. However, the SMS does not measure the most autonomous form of extrinsic motivation, integrated regulation, which is inconsistent with self-determination theory (SDT; Deci & Ryan, 1985) upon which the instrument is based. Moreover, several studies (e.g., Martens, & Webber, 2002) have questioned the factorial validity of the SMS. Hence, the purpose of this study was to develop a revised version of the SMS, including integrated regulation. Method: In Stage 1, the factorial validity of the SMS was examined using confirmatory factor analysis (CFA) on data collected from 614 Australians (elite athletes and university students). In Stage 2, the scale was revised by including integrated regulation items and replacing problematic items through an iterative process using CFA for data collected from 557 Australian university students. Concurrent validity of the revised scale was examined by evaluating correlations with the dispositional flow scale-2 (DFS-2; Jackson & Eklund, 2004). The revision led to development of a six-factor 24-item scale (SMS-6) that indicated a more parsimonious and improved fitting model consistent with SDT. Correlations between the SMS-6 and DFS-2 factors support the concurrent validity of the revised scale. From statistical and theoretical viewpoints, the revised SMS-6 was preferable to the original SMS, except for the discriminant validity issue of identification regulation. Further examination of the instrument is necessary by cross-validating the findings from this study.
SELECTED PUBLICATIONS

Value-based Stakeholder Loyalty Toward Sport Technology: A Case of the Electronic Body Protector and Scoring System in Taekwondo Events

Safety and Security Management at Sporting Events: Perceptions, Fan Experience, and Technology

The Influence on Consumer’s Trust and Attitude by Types of Subject Regarding Match Fixing Cases in Professional Sports

The Influence of Event Quality on Revisit Intention: Gender Difference and Segmentation Strategy

The Implementation of Automated External Defibrillators in Sport Facilities: Focused on Health/Fitness Facilities

Current Appointments
Assistant Professor
Coordinator, Visitors Coordination

Research Interest
- Legal and Policy Issues in Sport, Physical Activity and Recreation
- Risk Perception, Management Policies and Practices
- Event Management

Contact Information
Phone: 6790 3698
Email: chanmin.park@nie.edu.sg
Office location: NIE 5-03-23
Value-based Stakeholder Loyalty Toward Sport Technology: A Case of the Electronic Body Protector and Scoring System in Taekwondo Events


Only few studies have examined issues related to sport stakeholders’ (e.g., athletes’ spectators’ and coaches’) perceived value of technology products and its influence on the purchase intention of sport technology. The model of value-based stakeholders’ loyalty toward sport technology (MVLST) is offered to inform customer purchase intentions of technology based products by proposing theoretical relationships between perceived value, brand attitude, and purchase intention. The MVLST leverages core aspects of the technology acceptance model (TAM) and salient product attributes as quality, price, and innovativeness to develop the perceived value of sport technology (PVST).

To test the theoretical relationships proposed in MVLST, a structural equation model was performed. Finally, multi-group SEM was employed to examine the moderating effect of consumer involvement. A total 341 useful cases were collected from key stakeholders (e.g., spectators, coaches, and athletes) attending the 2010 US Open Taekwondo Championship; the technology-based product assessed by these survey participants was the electronic body protector and scoring system. The results of this analysis demonstrate that: (i) Usefulness, quality, and price are important value dimensions for attitude; (ii) conative loyalty (i.e., purchase intention) toward a sport technology occurs as consumers develop positive value perceptions and attitude toward the product; and (iii) the purchase intention of high vs. low involvement groups is dissimilarly influenced by the proposed value dimensions. From a theoretical perspective, the current study sheds light on the importance of attitude as a mediating variable and involvement as a moderating variable.

Keywords: Sport technology, value perception, Taekwondo event, technology acceptance model (TAM), scale development
Safety and Security Management at Sporting Events: Perceptions, Fan Experience, and Technology


Sport events have been impacted by the horrific events of 9/11 and they have been increasingly considered as a likely terrorist target. Sport event providers, thus, have to implement heightened security preparation and safety management. South Korea is going to host several large scale sporting events in the near future. The South Korean government has an overbearing duty to provide a safe and secure environment to all stakeholders involved. However, there is still a controversy about invasions of individual privacy because heightened security activities (i.e., bag search, pat-down search, body scanner) may not be fan friendly. In this study, the authors examined and found current issues regarding with safety and security management at sporting events. For example, the 22 professionals who are associated with collegiate sport safety operation answered that 100% of them do bag checks at gates, 27% had bag size requirements, and 14% used bomb sniffing dogs as a result of 9/11. Interestingly, 9% said that they no longer use volunteers at entrance gates due to heightened measure concerns. Under a consideration of more rigorous and intelligent systems, new technology (e.g., face recognition, unmanned aerial surveillance systems) needs to be appropriately utilized at mega sporting events. Additionally, sport facility and event managers should protect spectator privacy with using invasive monitoring technologies.

*Keywords*: Safety and security management, mega sport events, balancing security and fan experience, privacy invasion

The Influence on Consumer’s Trust and Attitude by Types of Subject Regarding Match Fixing Cases in Professional Sports


The purpose of this study was to examine differences of trust and attitude toward professional sports involved in match fixing cases and to test the effect on consumers’ behavioural intentions. Further, it attempted to provide fundamental data for managerial and legal discussion and potential action. Utilizing an online survey, this study collected data, in April 2013, from 372 participants who were identified by snowball sampling. The results suggested that there were significant differences in levels of trust depending on the types of match fixing cases; particularly, the effect of match fixing cases committed by coaching staffs was greater than those committed by individual athletes. Moreover, trust levels diminished from match fixing cases significantly influenced consumers’ behavioural intentions. Based on these results, suggestions regarding marketing and legal implications were discussed.

*Keywords*: Match fixing, subject, professional sports, trust, attitude

The purpose of this study is to examine the relationships between spectators’ event quality perceptions and revisit intention in both men’s and women’s basketball events by focusing on gender influence. The study utilized structural equation modeling (SEM) on data collected by questionnaire survey from a total of 623 spectators of two college men’s basketball events (n=292) and two college women’s basketball events (n=331).

The results indicate that for men’s basketball events, game performance and staff quality had a significant influence on the revisit intention of spectators, regardless of the spectator’s gender. For women’s basketball events, game performance, and in-game entertainment were significant determinants of spectator revisit intentions, again regardless of gender. The current research collected data from division I-A men’s and women’s basketball events in only one higher education institution. Further the current research adopted only four salient event quality factors (1.e., game performance, in-game entertainment, staff quality, and physical surrounding). Finally, current research measured only revisit intention as a dependent variable.

The findings suggest that game performance was found to be the most significant event quality factor regardless of gender in both men’s and women’s sporting events. Furthermore, in-game entertainment was another critical event quality factor for the revisit intention for women’s basketball events. In addition, females have more sensitive event quality perceptions in both men’s and women’s basketball events.

Keywords: Gender difference, event quality, college basketball events, revisit intention, moderating effect, consumer behavior
The Implementation of Automated External Defibrillators in Sport Facilities: Focused on Health/Fitness Facilities


Sudden cardiac arrest (SCA), a true medical emergency, signifies the cession of the heartbeat and breathing, and loss of consciousness. As a global health problem, more than 25,000 persons suffer SCA each year in South Korea. Since the chance of survival from SCA decreases by 7% to 10% each minute after unconsciousness, high survival rates are typically only found when the time from collapse to defibrillation is short. The use of automated external defibrillator (AED), which delivers an electrical shock to victims of SCA, has contributed to increased survival rates of SCA victims.

The increased number of accessible AEDs in public settings, including airports, shopping malls, schools, and sport arenas has led to significant increase in SCA survival rates. In the sport setting, many SCA cases have occurred among professional, collegiate, and recreational athletes, and teenagers with otherwise healthy hearts. SCA cases have occurred at sport venues such as health/fitness clubs, aquatic facilities, sport stadia/arenas, and golf courses. Health/fitness facilities, in particular, have been recognized as higher risk locations that may benefit from the implementation of AEDs.

To address SCA issues in South Korea, the government of South Korea amended the Emergency Medical Service Act in 2008. During this revision, several sub-paragraphs regarding AED implementation were inserted. In the 2011 revision, laws related the Good Samaritan Act (Article 5-2 and 63 of the Emergency Medical Service Act) state that even through an AED is a medical device; it can be used by trained laypersons in a medical emergency. Currently, however, legislation and guidelines do not exist in a medical emergency mandating or recommending the use of AEDs in health/fitness clubs.

The purpose of this study was to examine current AED legislations in South Korea and United States. Regulations and guidelines regarding health/fitness facilities in United States, also, were examined. Moreover, current implementation of AED in South Korean health/fitness facilities and manager’s relevant legal knowledge and certifications (i.e., CPR, AED) were investigated to understand current status of AED implementation.

The results of this study suggest the low level of AED implementation in health/fitness facilities in South Korea and the low level of manager’s knowledge regarding relevant AED laws, resulting primarily from a lack of exactly related AED legislation to health/fitness facilities. Also, staff certification and training of CPR/AED and protection from liability are other considerable issues. The findings contribute to the body of knowledge of AED implementation in South Korean health/fitness facility specially. It may contribute to future enactment of additional AED regulatory laws for sport venues in South Korea.

*Keywords*: Automated external defibrillator (AED), sport facility, health/fitness, public access defibrillator (PAD), cardiopulmonary resuscitation (CPR)
SELECTED PUBLICATIONS

How Does Advertising through Sport Work? Evidence from the Singapore Context 71

The Influences of Perceived Brand Quality and Ethnocentrism on Consumption Patterns of a Global Sport Brand: The Case of Korean College Students 71

Attitude Toward Advertising Through Sport: A Theoretical Framework 72

Test of Normality and Data Transformation in Sport Management Research 72

A Proposed Relationship Between Beliefs About and Attitude Toward Advertising through Sport 73

Perceived Leadership Behavior of Physical Education Teacher-Coaches: When they Teach vs. When they Coach 73

Perceived Coaching Leadership of Youth Athletes in Singapore 74

Testing for Multigroup Invariance of the Perceived Locus of Causality in Sport 74

Burnout as a Mediator of the Job Stress and Job Outcome Relationship 75

Enhancing Advertising Communications: Developing A Model of Beliefs about Advertising through Sport 75

PYUN Do Young
Ph.D

Current Appointments
Assistant Professor
Assistant Head (SSM), PESS

Research Interest
• Sport Marketing
• Advertising through Sport
• Globalization of Sport
• Coaching Leadership
• Competitive Balance in Professional Sport
• Motivation in e-Sport
• Job Outcomes in Sport Organizations
• Scale Development

Contact Information
Phone: 6790 3713
Email: doyoung.pyun@nie.edu.sg
Office location: NIE 5-03-33
How Does Advertising through Sport Work? Evidence from the Singapore Context


The purpose of this study was twofold. One was to compare consumers’ attitude toward advertising through sport with their attitudes toward advertising in general, television commercials, and online advertising. The other was to ascertain which advertising beliefs influenced consumers’ attitude toward advertising through sport. In Phase 1 (N = 263), a paired-sample t-tests revealed that the respondents’ attitude toward advertising through sport were significantly more positive than their attitudes toward advertising in general, television commercials, and online advertising. Next, with the data set 2 (n = 210), the proposed relationships between beliefs and attitude were tested using structural equation modeling (SEM). The SEM revealed that two beliefs, product information and hedonism/pleasure, significantly influenced attitude toward advertising through sport. The findings of the study provide an insightful foundation for understanding the development of consumers’ attitude toward advertising through sport and guide practical implications for marketing and advertising practice.

The Influences of Perceived Brand Quality and Ethnocentrism on Consumption Patterns of a Global Sport Brand: The Case of Korean College Students


This study assessed the mediation effect of perceived brand quality and the moderation effect of consumer ethnocentric tendency in the proposed consumption model of a global sport brand. The English Premier League was selected as a global sport brand, and four hypotheses were established to explain how consumers’ perceived brand globalness affected their watching intention. Results showed that perceived brand quality partially mediated the relationship between perceived brand globalness and watching intention, and ethnocentrism played a moderating role in this relationship. The findings provided important knowledge for understanding consumption activities of global sport brands and suggested practical implications.
Attitude Toward Advertising Through Sport: A Theoretical Framework


An important goal of advertising is designing effective campaigns that foster favorable attitudes toward a product. Attitude toward a product is influenced by one’s attitude toward an advertisement. Previous research examining attitude toward advertising in general and in specific mediums (e.g., TV and online) has found that consumers’ attitudes toward advertising have become increasingly negative. The researchers propose that sport is one advertising platform that may be utilized to foster positive attitudes toward advertising. A conceptual framework of attitude toward advertising through sport derived from the phenomenon of attitude toward advertising in general and in specific mediums is introduced. The proposed model includes antecedents (beliefs), a consequence (attitude toward the ad), and attitude toward sport as a moderator of the relationship between beliefs about and attitude toward advertising through sport.

Test of Normality and Data Transformation in Sport Management Research


The normality of data has been considered the most important assumption when researchers conduct factor analyses or structural equation modeling. This study addressed expected problems derived from the use of traditionally utilized normality test techniques in sport management literature and considered a more rigorous technique using z-scores of skewness and kurtosis. In addition, the study introduced possible remedies to repair non-normality of problematic items using certain mathematical operations. Along with empirical examples, the authors presented the following important issues and problems raised during the procedures of data transformations: (a) the rationale of a subtraction process for negatively skewed items; (b) the different functions of the square root and logarithm based on the severity of skewness and kurtosis; (c) the interpretation and report of results derived from transformed data with a subtraction process.
A Proposed Relationship Between Beliefs About and Attitude Toward Advertising through Sport


Pyun (2006) proposed a model of attitude toward advertising through sport which includes seven beliefs hypothesized to influence attitude. The current study provides an initial test of the model. Two randomly split samples were utilized for hypotheses and cross validation tests. The results of previous research have indicated that participants generally had negative attitudes toward advertising. The findings of the current study indicated that respondents generally had positive attitudes toward advertising through sport. The positive attitudes were influenced most by beliefs associated with product information and hedonism/pleasure. In contrast to previous studies, the respondents’ negative beliefs about advertising through sport were not related with their overall attitudes regarding the subject at hand. The findings of the study provide a foundation for understanding the development of consumers’ attitude toward advertising through sport and guide implications for marketing and advertising practice.

Perceived Leadership Behavior of Physical Education Teacher-Coaches: When they Teach vs. When they Coach


The objective of the study was to see whether a teacher-coach exhibits different types of leadership behavior when s/he teaches a PE class and coaches a group of athletes. A total of 117 students of mixed gender participated, including 64 PE students and 53 student-athletes from college floorball and canoeing teams. The data collection instrument used in this study was the Leadership Scale for Sports (Chelladurai & Saleh, 1980). A multivariate analysis of covariance indicated that training and instruction accounted for most of the differences between the PE students’ and the student-athletes’ perceived leadership behavior of their teacher/coaches; the student-athletes perceived their coaches to provide training and instruction more than did the PE students. In addition to training and instruction, the student-athletes perceived more positive feedback given to them than did the PE students. The other three dimensions of leadership did not show any statistically significant group difference.
Perceived Coaching Leadership of Youth Athletes in Singapore


This study examined youth student-athletes’ perceptions toward their coaches’ behaviors in Singapore, upon the conceptual framework of the Multidimensional Model of Leadership (Chelladurai, 1978). The specific focus of enquiry was to compare differences in perceived leadership in terms of an individual characteristic (i.e., gender), a situation characteristic (i.e., task dependence), and their interactions (i.e., gender by task dependence). A total of 544 athletes completed the perception version of the Leadership Scales for Sports developed by Chelladurai and Saleh (1980). A multivariate analysis of variance was conducted in the study. For task dependence, the athletes of interdependent sports perceived their coaches to be more socially supportive than their counterpart. For gender by task dependence, first, the female interdependent sports athletes had a significantly higher mean score than the male interdependent sports athletes for training and instruction. Second, the male interdependent sports athletes reported a significantly higher mean score than the male and female independent sports athletes for social support. The female interdependent sports athletes had a significantly higher mean score than the male and female independent sports for social support. Lastly, the female interdependent sports athletes had a significantly higher mean score than the male interdependent sports athletes for positive feedback. Understanding the athletes’ perceptions on leadership behaviors will help coaches and sport administrators increase athletes’ satisfaction and performance and eventually achieve sporting excellence in Singapore.

Testing for Multigroup Invariance of the Perceived Locus of Causality in Sport


One popular scale in measuring motivation in sport is the perceived locus of causality (PLOC). While the scale has been widely utilized in sport, there is lack of empirical evidence to support the equivalence of the scale across diverse age groups. The Singapore government has recently initiated a new project to propel youths’ participation in sport. For an effective implementation of the project, it is important to develop students’ interests and motivation to continue their involvement and behavioural persistence for sport. The purpose of the study was to test the invariance of all PLOC items proposed to measure their respective factors across three age groups. A sample of 3289 students took part in the study. The results revealed that several items were perceived differently across the students in the three academic groups.
**Burnout as a Mediator of the Job Stress and Job Outcome Relationship**


The purpose of this research was to investigate the mediating effect of burnout in the job stress and job outcome relationship using two competing mediation models (i.e., full mediation and partial mediation). The two models were developed based on the ‘beyond the role stress model’ (Fogarty, Singh, Rhoads, & Moore, 2000). The data were collected from 374 ski instructors and patrols in South Korea. The results showed that the partial mediation model had a better fit to the data, indicating that the job stress influenced job satisfaction and turnover intention directly as well as indirectly via burnout. A management of ski resort may reduce the negative job outcomes by disconnecting the linkages between stress and burnout as well as between stress and satisfaction/turnover intentions.

**Enhancing Advertising Communications: Developing a Model of Beliefs about Advertising through Sport**


A challenge with advertising communications is better understanding beliefs driving one’s attitude toward advertising. Successful use of sport communications requires a better understanding of the beliefs comprising attitudes toward advertising through sport. A four-phase study was conducted to develop a scale measuring seven belief dimensions as indicants of attitude toward advertising through sport. Phase 1 (n = 125) provided an initial test of the proposed instrument. Phase 2 (n = 215) included an assessment of the revised scale based on internal consistency tests and exploratory factor analysis. In Phase 3 (n = 424) the scale’s reliability and validity were verified using confirmatory factor analysis. In Phase 4 (n = 263) the internal consistency and factor structure of the scale were re-examined. The combined results provide support for the conceptualization and measurement of the belief dimensions for future investigation of the relationships between beliefs about and attitude toward advertising through sport.
SELECTED PUBLICATIONS

Effects of Acute Exercise on Postprandial Triglyceride Response After a High-Fat Meal in Overweight Black and White Adolescents 77

Effect of Sprint Interval versus Continuous Cycling on Postprandial Lipaemia 77

Oxygen Consumption, Substrate Oxidation, and Blood Pressure Following Sprint Interval Exercise 78

Beneficial Effects of Combined Olive Oil Ingestion and Acute Exercise on Postprandial TAG Concentrations in Healthy Young Women 78

Brisk Walking Offsets the Increase in Postprandial TAG Concentrations Found when Changing to a Diet with Increased Carbohydrate 79

Multiple Bouts of Resistance Exercise and Postprandial Triacylglycerol and Serum C-Reactive-Protein Concentrations 79

Accumulating Short Bouts of Brisk Walking Reduces Postprandial Plasma Triacylglycerol Concentrations and Resting Blood Pressure in Healthy Young Men 80

Exercise-Induced Suppression of Acylated Ghrelin in Humans 80

Increased Postprandial Triacylglycerol Concentrations following Resistance Exercise 81

A Single Session of Resistance Exercise Does Not Reduce Postprandial Lipaemia 81
Effects of Acute Exercise on Postprandial Triglyceride Response after a High-Fat Meal in Overweight Black and White Adolescents


**Objective:** We examined the effects of acute exercise on postprandial triglyceride (TG) metabolism following a high-fat meal in overweight black vs. white adolescents. **Design and Subjects:** Twenty-one black and 17 white adolescents (12–18 yrs, body mass index ≥85th percentile) were evaluated twice, during control versus exercise trials, 1–4 weeks apart, in a counterbalanced randomized design. In the control trial, participants performed no exercise on day 1. In the exercise trial, participants performed a single bout of 60-min exercise (50% VO₂ peak) on a cycle ergometer on day 1. On day 2 of both trials, participants consumed a high-fat breakfast (70% calories from fat) and blood was sampled for TG concentration in the fasted state and for 6 h postprandially. **Results:** There was a significant main effect of condition on postprandial peak TG concentration (P=0.01) and TG area under the curve (AUC) (P=0.003), suggesting that independent of race, peak TG and TG-AUC was lower in the exercise trial vs control trial. Including Tanner stage, gender, total fat (kg) and visceral adipose tissue (VAT) as independent variables, stepwise multiple regression analyses revealed that in whites, VAT was the strongest (P<0.05) predictor of postprandial TG-AUC, explaining 56 and 25% of the variances in TG-AUC in the control and exercise trials, respectively. In blacks, VAT was not associated with postprandial TG-AUC, independent of trial. **Conclusion:** A single bout of aerobic exercise preceding a high-fat meal is beneficial to reduce postprandial TG concentrations in overweight white adolescents to a greater extent than black adolescents, particularly those with increased visceral adiposity.

Effect of Sprint Interval versus Continuous Cycling on Postprandial Lipaemia


The present study compares the effect of a single bout of sprint interval cycling against continuous cycling on postprandial lipaemia. Participants were nine healthy volunteers (five male), aged 20–26 years. Each participant undertook three 2-d trials in a random order. On day 1, participants rested (control), undertook a single 20 minute bout of continuous cycling at 70% of maximum oxygen uptake or completed four 30-second bouts of sprint interval cycling on a cycle ergometer, separated by 4.5 minutes of recovery. On day 2, participants rested and consumed a test meal (75% fat). Triacylglycerol concentrations were measured fasting and for 6 hours after the meal. The total area under the triacylglycerol concentration against time curve was similar among trials (mean (SD): control, 9.51 (3.50) mmol·L⁻¹ compared with continuous cycling, 8.58 (3.08) mmol·L⁻¹ compared with sprint interval cycling, 9.28 (1.89) mmol·L⁻¹; P = 0.517). There was no difference in the pattern of TAG response to the test meal among trials (trial × time interaction, P = 0.637). The present study found no effect of sprint interval or continuous cycling on postprandial lipaemia, with the reason for this finding unclear. Future studies need to more precisely determine the relationship between exercise and postprandial lipaemia across different types of exercise.
Oxygen Consumption, Substrate Oxidation, and Blood Pressure Following Sprint Interval Exercise


This study examined the acute effect of sprint interval exercise (SIE) on postexercise oxygen consumption, substrate oxidation, and blood pressure. The participants were 10 healthy males aged 21–27 years. Following overnight fasts, each participant undertook 2 trials in a random balanced order: (i) four 30-s bouts of SIE on a cycle ergometer, separated by 4.5 min of recovery, and (ii) resting (control) in the laboratory for an equivalent period. Time-matched measurements of oxygen consumption, respiratory exchange ratio, and blood pressure were made for 2 h into recovery. Total 2-h oxygen consumption was significantly higher in the SIE than in the control trial (mean ± SD: Control: 31.9 ± 6.7 L vs Exercise: 45.5 ± 6.8 L, *p* < 0.001). The rate of fat oxidation was 75% higher 2 h after the exercise trial compared with the control trial (Control: 0.08 ± 0.05 g *min*⁻¹ vs Exercise: 0.14 ± 0.06 g *min*⁻¹, *p* = 0.035). Systolic blood pressure (Control: 117 ± 8 mmHg vs Exercise: 109 ± 8 mmHg, *p* < 0.05) and diastolic blood pressure (Control: 84 ± 6 mmHg vs Exercise: 77 ± 5 mmHg, *p* < 0.05) were significantly lower 2 h after the exercise trial compared with the control trial. These data showed a 42% increase in oxygen consumption (~13.6 L) over 2 h after a single bout of SIE. Moreover, the rate of fat oxidation increased by 75%, whereas blood pressure was reduced by ~8 mmHg 2 h after SIE. Whether these acute benefits of SIE can translate into long-term changes in body composition and an improvement in vascular health needs investigation.

Beneficial Effects of Combined Olive Oil Ingestion and Acute Exercise on Postprandial TAG Concentrations in Healthy Young Women


Foods high in monounsaturated fat, such as olive oil, and endurance exercise are both known to independently reduce postprandial TAG concentrations. We examined the combined effects of exercise and dietary fat composition on postprandial TAG concentrations in nine healthy pre-menopausal females (age 26·8 (SD 3·3) years, BMI 22·3 (SD 2·0) kg/m²). Each participant completed four, 2 d trials in a randomized order: (1) butter–no exercise, (2) olive oil–no exercise, (3) butter–exercise, (4) olive oil–exercise. On day 1 of the exercise trials, participants walked or ran on a treadmill for 60 min. On the no-exercise trials, participants rested on day 1. On day 2 of each trial, participants rested and consumed an olive oil meal (saturated fat 15% and unsaturated fat 85 %) or a butter meal (saturated fat 71% and unsaturated fat 29 %) for breakfast. Venous blood samples were obtained in the fasted state and for 6 h postprandially on day 2. A significant main effect on physical activity (exercise or control) was obtained for plasma TAG concentration (three-way ANOVA, *P* = 0·043), and the total area under the concentration v. time curve for TAG was 26% lower on the olive oil–exercise trial (4·40 (SD 0·40) mmol × 6 h/l) than the butter–no exercise trial (5·91 (SD 1·01) mmol × 6 h/l) (one-way ANOVA, *P* = 0·029). These findings suggest that the combination of exercise and a preference for monounsaturated dietary fat intake in the form of olive oil may be most beneficial for reducing postprandial TAG concentrations.

We tested the hypothesis that 30 min of brisk walking daily would offset the increase in plasma TAG concentrations associated with substituting dietary fat for carbohydrate. Fourteen subjects (six males) aged 57 (SD 5) years underwent three 4 d trials in a counterbalanced order: (i) 4 d on a typical UK diet (40% energy from fat, 45% carbohydrate and 15% protein); (ii) 4 d on an isoenergetic diet but substituting fat for carbohydrate in line with the present recommendations (30% fat, 55% carbohydrate and 15% protein); (iii) 4 d on the same recommended diet with 30 min of brisk walking each day. The food provided for the first 3 d of each trial was isoenergetic with each volunteer’s previously determined daily energy intake. On day 4, the subjects consumed breakfast, lunch and an early evening meal, equivalent in total to 90% of their daily energy intake. Blood samples were collected and substrate utilisation and energy expenditure were determined in the fasted state and for 9 h postprandially. Substrate utilisation differed significantly among trials ($P=0.003$); RER was higher on the recommended diet trial than during either of the other two trials ($P=0.012$ and $0.021$ for the UK diet and recommended diet with walking, respectively). The rise in plasma TAG concentrations over the day was steeper on the recommended diet trial than on the other two trials (trial × time interaction, $P=0.040$). The increase in postprandial TAG concentrations associated with substituting dietary fat for carbohydrate was offset by 30 min of brisk walking daily.


The present study examined how multiple bouts of resistance exercise, performed over 1 d, influence 2 risk factors—postprandial triacylglycerol (TAG) and serum C-reactive-protein (CRP) concentrations—associated with coronary heart disease. Twenty-four men age 23.5 (SD 3.4) y completed two 2-d trials, exercise and control, at least 1 wk apart in a counterbalanced randomized design. On day 1 of the exercise trials participants completed 20 sets of 15 repetitions of 5 different resistance exercises divided into five 45-min bouts of exercise—100 sets and 1500 repetitions in total for all exercises. Exercises were performed at 30–40% of 1-repetition maximum. Blood samples were taken before and after exercise. On day 1 of the control trial participants were inactive, with blood samples taken at time points corresponding to the exercise trial. On day 2 of both trials participants consumed a test meal (0.89 g fat, 1.23 g carbohydrate, 0.4 g protein, 60 kJ per kg body mass). Blood samples were obtained fasted and for 6 h postprandially. Total area under the postprandial TAG concentration versus time curve was 12% lower in the exercise than in the control trial (8.76 [3.54] vs. 9.94 [4.31] mmol·L$^{-1}$·6 h, respectively; $P = 0.037$). Serum CRP concentrations did not change over the 2 d in the control trial but increased in the exercise trial: trial × time interaction ($P = 0.028$). Multiple bouts of resistance exercise reduce postprandial TAG concentrations but increase serum CRP concentrations. The extent to which these findings are clinically relevant requires further study.
Accumulating Short Bouts of Brisk Walking Reduces Postprandial Plasma Triacylglycerol Concentrations and Resting Blood Pressure in Healthy Young Men


Background: Physical activity recommendations promote the accumulation of aerobic activity in bouts of ≥10 min. It is important to determine whether shorter bouts of activity can influence health. Objective: We compared the effects of accumulating ten 3-min bouts of brisk walking with those of one 30-min bout of brisk walking on postprandial plasma triacylglycerol concentrations and resting blood pressure. Design: Fifteen healthy young men completed three 2-d trials ≥1wk apart in a randomized, repeated-measures design. On day 1, subjects rested (no exercise) or walked briskly in either ten 3-min bouts (30 min rest between each) or one 30-min bout (gross energy expenditure: 1.10 MJ/30 min). On day 2, subjects rested and consumed high-fat test meals for breakfast and lunch. Results: On day 2 area under the plasma triacylglycerol concentration over time curve was 16% lower on the accumulated and continuous brisk walking trials than on the control trial (mean ± SEM: 9.98 ± 0.67 compared with 9.90 ± 0.76 compared with 11.90 ± 1.02 mmol∙7h/L, respectively; P = 0.005, one-factor ANOVA). Resting systolic blood pressure was 6–7% lower throughout day 2 on the accumulated and continuous trials than on the control trial (109 ± 1 compared with 110 ± 1 compared with 117 ± 2 mm Hg, respectively; P < 0.0005). Conclusion: Accumulating 30 min of brisk walking in short (3-min) bouts is equally effective in reducing postprandial lipemia and systolic blood pressure as is one continuous 30-min bout.

Exercise-Induced Suppression of Acylated Ghrelin in Humans


Ghrelin is an orexigenic hormone secreted from endocrine cells in the stomach and other tissues. Acylation of ghrelin is essential for appetite regulation. Vigorous exercise induces appetite suppression, but this does not appear to be related to suppressed concentrations of total ghrelin. This study examined the effect of exercise and feeding on plasma acylated ghrelin and appetite. Nine male subjects aged 19–25 yr participated in two, 9-h trials (exercise and control) in a random crossover design. Trials began at 0800 in the morning after an overnight fast. In the exercise trial, subjects ran for 60 min at 72% of maximum oxygen uptake between 0800 and 0900. After this, they rested for 8 h and consumed a test meal at 1100. In the control trial, subjects rested for 9 h and consumed a test meal at 1100. Area under the curve values for plasma acylated ghrelin concentration (assessed from venous blood samples) were lower over the first 3 h and the full 9 h of the exercise trial compared with the control trial: 317 ± 135 vs. 510 ± 186 pg·ml⁻¹·3 h and 917 ± 342 vs. 1,401 ± 521 pg·ml⁻¹·9 h (means ± SE) respectively (P<0.05). Area under the curve values for hunger (assessed using a visual scale) were lower over the first 3 h of the exercise trial compared with the control trial (P=0.013). These findings demonstrate that plasma acylated ghrelin concentration and hunger are suppressed during running.
Increased Postprandial Triacylglycerol Concentrations following Resistance Exercise


**Purpose:** There is conflicting evidence whether a single bout of resistance exercise performed the day before a test meal can lower postprandial triacylglycerol (TAG) concentrations. The present study examined the effect of a single session of resistance exercise, performed the same day as a test meal, on postprandial TAG concentrations in resistance-trained males. **Methods:** Ten healthy males aged 25 (SD 2.6) yr performed two trials at least 1 wk apart in a counterbalanced, randomized design. In each trial, participants consumed a test meal (0.89 g of fat, 1.23 g of carbohydrate, 0.4 g of protein, 60 kJ·kg⁻¹ body mass). Before one meal, participants performed a 90-min bout of resistance exercise. Before the other meal, participants were inactive (control trial). Resistance exercise was performed using free weights and included three sets of 12 repetitions of each of 10 exercises. Sets were performed at 80% of 12-repetition maximum with a 3-min work and rest interval. Venous blood samples were obtained in the fasted state and for 5 h postprandially. **Results:** Total area under the plasma TAG concentration versus time curve was higher (Student’s t-test P = 0.008) on the exercise than control trial (mean ± SE: 11.76 ± 1.64 vs. 7.94 ± 1.08 mmol·L⁻¹·5 h⁻¹, respectively). Total area under the plasma myoglobin concentration versus time curve was higher (Student’s t-test P = 0.010) on the exercise than control trial (16.68 ± 3.34 vs. 6.80 ± 0.64 nmol·L⁻¹·6 h⁻¹; respectively). **Conclusion:** A single bout of resistance exercise can cause a transient elevation in postprandial TAG concentrations. The elevations in plasma myoglobin suggest postexercise muscle damage. Further investigation is needed to see if these findings are linked.

A Single Session of Resistance Exercise Does Not Reduce Postprandial Lipaemia


This study investigated the effect of a single session of resistance exercise on postprandial lipaemia. Eleven healthy normolipidaemic men with a mean age of 23 (standard error ± 1.4) years performed two trials at least 1 week apart in a counterbalanced randomized design. In each trial, participants consumed a test meal (1.2 g fat, 1.1 g carbohydrate, 0.2 g protein and 68 kJ·kg⁻¹ body mass) between 08.00 and 09.00 h following a 12 h fast. The afternoon before one trial, the participants performed an 88 min bout of resistance exercise. Before the other trial, the participants were inactive (control trial). Resistance exercise was performed using free weights and included four sets of 10 repetitions of each of 11 exercises. Sets were performed at 80% of 10-repetition maximum with a 2 min work and rest interval. Venous blood samples were obtained in the fasted state and at intervals for 6 h postprandially. Fasting plasma triacylglycerol (TAG) concentration did not differ significantly between control (1.03 ± 0.13 mmol·l⁻¹) and exercise (0.94 ± 0.09 mmol·l⁻¹) trials (mean ± standard error). Similarly, the 6 h total area under the plasma TAG concentration versus time curve did not differ significantly between the control (9.84 ± 1.40 mmol·l⁻¹·6 h⁻¹) and exercise (9.38 ± 1.12 mmol·l⁻¹·6 h⁻¹) trials. These findings suggest that a single session of resistance exercise does not reduce postprandial lipaemia.
SELECTED PUBLICATIONS

A Traumatic Upper Limb Injuries During the Men’s Field Hockey Junior World Cup 2009

The NIE Intermittent High-Intensity Running Test: A Reliable and Valid Test for Assessment of Soccer-Specific Fitness

Head and Face Injuries during the Men’s Field Hockey Junior World Cup 2009

Hydration Status of Heat-Acclimatized Youth Team Players During Competition

Within-season Variation in the Body Composition of Asian Youth Professional Soccer Players

Urinary Total Antioxidant Capacity in Soccer Players

Validity of the Running Repeated Sprint Ability Test Among Playing Positions and Level of Competitiveness in Trained Soccer Players

Relationship between Measured Maximal Oxygen Uptake and Aerobic Endurance Performance with Running Repeated Sprint Ability in Young Elite Soccer Players

Swarup MUKHERJEE
MBBS, PGDSM, Ph.D

Current Appointments
Assistant Professor
Coordinator, PESS Diploma Programme
Coordinator, E-Champion

Research Interest
• Sports Injuries Prevention and Management
• Fundamental movement skills, physical activity and health in children
• Exercise Physiology

Contact Information
Phone: 6790 3680
Email: swarup.mukherjee@nie.edu.sg
Office location: NIE 5-03-06B
A Traumatic Upper Limb Injuries during the Men’s Field Hockey Junior World Cup 2009


This study was a prospective epidemiological investigation of upper limb injuries during the Men’s Field Hockey Junior World Cup 2009. 324 players were observed in 58 matches of the tournament. 28 upper limb-related injuries were documented. The injury incidence was 0.48 per match and 19 per 1000 match hours. Most injuries were due to contact with the ball and left hand was the most commonly injured part. Contusion was the commonest type of injury. The odds ratio for hand and wrist injuries in players not wearing gloves was 4.01 (95% CI, 0.52-30.62) and the relative risk of hand and wrist injuries in players wearing gloves was 0.26 (95% CI, 0.03-1.92). Male youth hockey players are at a high risk of upper limb especially hand and wrist injuries during major international tournaments and that use of protective gloves can provide significant protection against hand and wrist injuries in the sport.

*Keywords*: Field hockey, upper limb injuries, elite youth player, international tournament

The NIE Intermittent High-Intensity Running Test: A Reliable and Valid Test for Assessment of Soccer-Specific Fitness


The overall activity pattern of soccer is that of intermittent high-intensity (Int-HINT) type and elite players have a greater repeated high-intensity running capability. Since soccer involves rapidly changing work intensities in an unpredictable manner, tests simulating overall activity pattern in a cyclical sequence have limited practical usefulness in testing of soccer fitness. The primary aim of this study was to develop a laboratory-based protocol to specifically assess the Int-HINT running capability in soccer players. University team games athletes (n=8, Mean ± SD; age 22.30 ± 1.65 years, stature 1.73 ± 0.04 m, body mass 69.36 ± 6.04 kg) participated in the reliability study and male youth professional soccer players (n=20, Mean ± SD age, 17.5 ± 0.3 yrs; stature, 1.73 ± 0.04 m; body mass, 67.2 ± 7.5 kg) participated in the validity study. The players performed on the NIE Intermittent High-intensity (NIE Int-HINT) Running Test during the pre-season, early in-season and end mid-season phases of the soccer season. Performance was measured as total distance covered on the treadmill. The participants also performed the YoYo Intermittent Recovery Test Level 2 (YoYo IRT L2) during each phase of the competition season. The NIE Int-HINT test was found to be of high reliability (ICC, 0.98; CV, 2.1%; ratio limits of agreement (rLOA) 0.99 /±/ 1.03). A positive and significant correlation (p<0.05) was found between the performance in the NIE Int-HINT test and the YoYo IRT L2 performance (r = 0.68-0.77) during different phases of the soccer season. The NIE Int-HINT test provided a reliable measure of intermittent high-intensity running capability and a valid and sensitive method of estimating soccer-specific fitness in youth professional soccer players. Further studies are needed to evaluate the applicability of this test in adult elite soccer players and other intermittent team game athletes.

*Keywords*: Soccer, intermittent high-intensity exercise, NIE Int-HINT protocol, youth soccer players

**Background:** Head and face injuries in field hockey is a concern. However, published data on injuries in field hockey is minimal with apparently no reports on head and face injuries in elite youth hockey players during major international tournaments. **Purpose:** To provide a descriptive account of head and face injuries in elite youth male field hockey players during the Men’s Junior World Cup 2009. **Study Design:** Descriptive epidemiological study. **Methods:** A total of 324 players were observed during 58 matches in the tournament. The injury reporting system was based on that used in team sports during international tournaments. All the head and face injury documentation was done by direct on-location observation by trained sports medicine physician followed by confirmation from the team doctors or physiotherapists. **Results:** A total of 24 head and face injuries were documented. The overall injury frequency rate was 16 per 1000 match hours and 19 per 1000 player matches. Most injuries were of contact type with head being the commonest site and contusion being the commonest type of injury. The incidence of injuries was higher during the second-half and during the medal/ranking phase of the tournament. **Conclusions:** The risks of head and face injuries are high in elite youth players with potential of both short and long-term player time loss in international tournaments. Rules restricting body contact can significantly reduce the chances of the head and face injury in elite youth field hockey players. In addition, player education on the injury risks and safe practices at the developmental stages is desirable to prevent injuries and prolong sporting careers.

**Keywords:** Head and face injuries, field hockey, elite youth player, Junior World Cup 2009


**Objective:** The aim of the study was to investigate the hydration status of heat-acclimatized youth team players during a hockey competition. **Method and results:** Forty male hockey players (age: 12.3±0.5 yrs) had body mass (via weighing scale) and urine specific gravity (UrineSG) (via refractometry) measured immediately pre and post-tournament after playing three matches of 6 min duration on a modified pitch (30m×22 m), separated by a rest interval in the shade of 18 min (overall heat exposure was 54 min). The tournament was held in March and during 0830—1130 h in tropical weather conditions (31.5±0.2℃; relative humidity 84.2±0.4%). Chilled mineral water, an isotonic sports drink, a Milo beverage were freely available to players throughout the tournament. Among the players who arrived at the tournament site, 97.5% already showing signs of dehydration (UrineSG > 1.010), increasing to 100% after the tournament. Body mass changes amounted to 3.25% ($P < 0.05$) demonstrating significant dehydration among players. Heat-acclimatized youth team players are vulnerable to dehydration prior to competition and dehydration was significantly exacerbated after the competition despite the availability of isotonic drinks. **Conclusion:** Individualized player hydration routines and coach education on the importance of hydration before, during and after tournament are recommended.
Body composition is an important aspect of soccer fitness. There is a dearth of longitudinal data on the intraseasonal variation in the body composition parameters of youth professional soccer players especially of Asian origin. This study assessed the body composition profile of the Asian youth professional soccer players (n=20; Mean ± SD, age 17.5 ± 0.3 years, stature 1.73 ± 0.04 m, body mass 67.2 ± 7.5 kg) through the entire season. Body mass, percentage body fat (% BF), lean body mass (LBM) and bone mineral density (BMD) of outfield youth professional soccer players was determined using dual-energy x-ray absorptiometry (DXA) during the pre-season, early in-season and end mid-season respectively. Results showed that the Asian youth professional soccer players had similar anthropometric characteristics compared to Asian adult elite players but were shorter and lighter than European youth players. There was a significant decrease (p < 0.05) in the % BF and a significant increase (p < 0.05) in LBM during the pre-season period. However, negative adaptations during the competition phase indicated that training and competition load was insufficient to improve or maintain the adaptations in the % BF and LBM. The whole body BMD significantly increased through the soccer season. Area-specific BMD of the pelvis and the lower limbs showed positive osteogenic adaptations during the soccer season. Our results showed that the body composition parameters of Asian youth professional soccer players change through the soccer season. Such data can expand the bases of comparison between different soccer playing populations and add to the prospects of research on soccer performance. Further studies on the effect of body composition parameters on different aspects of soccer performance are desirable.

*Keywords:* Youth professional soccer players, Asian, body composition, soccer season
Both aerobic and anaerobic exercise contributes to oxidative stress by generation of free radicals. The human body is well equipped with both enzymatic and non-enzymatic antioxidant defence system. Soccer predominantly involves aerobic exercise with repeated bouts of anaerobic activities. The response of the different antioxidants to exercise might be sports-specific and hence the total antioxidant capacity (TAC) provides a better appraisal of the different antioxidant mechanisms of the body. TAC is the sum of the activities of antioxidants present in the material studied. The objective of the present study was to assess the urinary TAC (uTAC) in professional soccer players in different phases of the playing season and to compare the uTAC between professional, amateur and recreational soccer players. 21 professional, 20 amateur and 18 recreational players participated in the study. Results showed that the uTAC in the professional soccer players during pre-season (phase -1), early in-season (phase -2) and during the start of the end-season (phase - 3) was (mean ± SD) 3.13 ± 0.09, 2.73 ± 0.37 and 2.99 ± 0.41 mmol·L-1 respectively. The uTAC of the amateur and the recreational players during the start of end-season phase was 2.89 ± 0.44 and 1.77 ± 0.66 mmol·L-1 respectively. Repeated Measures ANOVA revealed significant difference (p < 0.05) in the uTAC between phase-1 and phase-2 while no significant difference was detected between the other phases in the professional soccer players. One-way ANOVA revealed significant difference (p < 0.05) between the uTAC of the recreational players and the amateur and professional players while there was no significant difference (p > 0.05) in the uTAC between amateur and professional players. In conclusion, the present study found that the uTAC in professional soccer players changes through the course of the competitive season especially at the start of the early in-season period. Further, this study also found that the uTAC in both amateur and professional was higher than in the recreational soccer players. Further research is required to determine the response of the specific antioxidants to soccer training and performance during the different phases of the season and at different levels of participation.

Keywords: Oxidative stress, antioxidant defence, urinary total antioxidant capacity, soccer players
Validity of the Running Repeated Sprint Ability Test among Playing Positions and Level of Competitiveness in Trained Soccer Players


The purpose of this study was to examine the construct validity of the running repeated sprint ability (rRSA) test to discriminate between: i) various playing positions (Study 1), and ii) groups of different level of competitiveness (Study 2) in trained soccer players. Study 1 comprised clubs’ players participating in the top local professional league. Study 2 comprised professional and semi-professional players from the National Under-23 and Youth squads respectively, and amateur-level players from a University team. The rRSA test protocol consisted of either 6 or 8 repetitions of 20-m all-out sprints, interspersed with a 20 s active recovery period. There were significant differences in the rRSA performance between goalkeepers and outfield-positions ($p<0.01$). Forwards had significantly higher rRSA compared to defenders and midfielders ($F$ ratio=4.147, $p=0.02$). Performance in the rRSA was superior in the teams with higher competitive levels ($F$ ratio = 3.973, $p=0.02$). The rRSA is a specific physical or fitness attribute of an outfield-position player, and may be of greater importance to the forwards’ position. Performance in the rRSA also seems to be associated with higher level of competitiveness and/or adaptation to resistance training. These data support the construct validity of the rRSA test in soccer players.

Relationship between Measured Maximal Oxygen Uptake and Aerobic Endurance Performance with Running Repeated Sprint Ability in Young Elite Soccer Players


**Aim:** The aim of the study was to determine the relationships between maximal oxygen uptake ($VO_{2max}$) in a maximal treadmill run and the aerobic endurance performance in the 20-m multistage shuttle run (MST) test, with the performance indices obtained in the running repeated sprint ability (rRSA) test, in elite youth soccer players. **Methods:** Thirty-seven adolescent male outfield players performed on separate days and in random order, the treadmill run test and the MST, to obtain their measured $VO_{2max}$ and aerobic endurance performance (via the number of completed shuttles in the MST), respectively. Players also completed the rRSA test of 6 x 20-m all-out sprints, interspersed with 20 s of active recovery. **Results:** There was a significant moderate correlation between measured $VO_{2max}$ (in L·min$^{-1}$ and ml·kg$^{-1}$·min$^{-1}$) and aerobic endurance performance ($r = 0.43$ and 0.54, $P<0.05$, respectively). There was no significant correlation between measured $VO_{2max}$ and aerobic endurance performance, and with any of the performance indices in the rRSA test (all $P>0.05$). **Conclusion:** The moderate association between the measured $VO_{2max}$ and MST suggest that both tests were plausibly measuring different aspects of a player’s aerobic fitness. The lack of a association between measured $VO_{2max}$ and aerobic endurance performance in the MST suggests aerobic fitness per se is poorly associated with performance in the rRSA in elite youth soccer players.

**Keywords:** Oxygen consumption, running, soccer
SELECTED PUBLICATIONS

Warm-up and Performance in Competitive Swimming

Characterization of Speed Fluctuation and Drag Force in Young Swimmers: A Gender Comparison

Young Swimmers' Classification Based on Kinematics, Hydrodynamics, and Anthropometrics

The Interaction Between Intra-Cyclic Variation of the Velocity and mean Swimming Velocity in Young Competitive Swimmers

Shoulder Rotator Cuff Balance, Strength, and Endurance in Young Swimmers During A Competitive Season

Tracking the Performance, Energetics and Biomechanics of International versus National Level Swimmers During a Competitive Season

Linking Selected Kinematics, Anthropometric and Hydrodynamic Variables to Young Swimmer Performance

Stability of Elite Freestyle Performance from Childhood to Adulthood

Energetics and Biomechanics as Determining Factors of Swimming Performance: Updating the State of the Art

Tiago M. BARBOSA
Ph.D

Current Appointments
Assistant Professor
Coordinator, SSM Final Year Project and URECA

Research Interest
• Biomechanics
• Performance
• Individual Sports

Contact Information
Phone: 6790 3774
Email: tiago.barbosa@nie.edu.sg
Office location: NIE 5-03-31
Warm-up and Performance in Competitive Swimming


Warm-up before physical activity is commonly accepted to be fundamental, and any priming practices are usually thought to optimize performance. However, specifically in swimming, studies on the effects of warm-up are scarce, which may be due to the swimming pool environment, which has a high temperature and humidity, and to the complexity of warm-up procedures. The purpose of this study is to review and summarize the different studies on how warming up affects swimming performance and to develop recommendations for improving the efficiency of warm-up before competition. Most of the main proposed effects of warm-up, such as elevated core and muscular temperatures, increased blood flow and oxygen delivery to muscle cells and higher efficiency of muscle contractions, support the hypothesis that warm-up enhances performance. However, while many researchers have reported improvements in performance after warm-up, others have found no benefits to warm-up. This lack of consensus emphasizes the need to evaluate the real effects of warm-up and optimize its design. Little is known about the effectiveness of warm-up in competitive swimming, and the variety of warm-up methods and swimming events studied makes it difficult to compare the published conclusions about the role of warm-up in swimming. Recent findings have shown that warm-up has a positive effect on the swimmer’s performance, especially for distances greater than 200 m. We recommend that swimmers warm-up for a relatively moderate distance (between 1000 to 1500 m) with a proper intensity (a brief approach to race pace velocity) and recovery time sufficient to prevent the early onset of fatigue and to allow the restoration of energy reserves (8 to 20 min).

Characterization of Speed Fluctuation and Drag Force in Young Swimmers: A Gender Comparison


The aim of this study was to compare the speed fluctuation and the drag force in young swimmers according to gender. Twenty-three young pubertal swimmers (twelve boys and eleven girls) volunteered as subjects. Speed fluctuation was measured with a kinematics’ mechanical method (i.e. speedo-meter) during a maximal 25 m Front crawl bout. Active drag, active drag coefficient and power needed to overcome drag were measured with the velocity perturbation method for another two maximal 25 m at Front Crawl with and without the perturbation device. Passive drag and passive drag coefficient were estimated with the gliding decay velocity method after a maximal push-off from the wall fully immersed. The technique drag index was also assessed as a ratio between active and passive drag. Boys presented a meaningful higher speed fluctuation, active drag, power needed to overcome drag and technique drag index than the girls. There were no significant differences according to gender for active drag coefficient, passive drag and passive drag coefficient. There were positive and moderate-strong associations between active drag and speed fluctuation when controlling the effects of the swim velocity. So, increasing speed fluctuation leads to higher drag force values and those are even higher for boys than for girls.
Young Swimmers' Classification Based on Kinematics, Hydrodynamics, and Anthropometrics


The aim of this paper was to classify swimmers based on kinematics, hydrodynamics, and anthropometrics. Sixty-seven young swimmers made a maximal 25 m front-crawl to measure with a speedometer the swimming velocity (v), speed-fluctuation (dv) and dv normalized to v (dv/v). Another two 25 m bouts with and without carrying a perturbation device were made to estimate active drag coefficient (CDa). Trunk transverse surface area (S) was measured with photogrammetric technique on-land and in the hydrodynamic position. Cluster 1 was related to swimmers with a high speed fluctuation (i.e., dv and dv/v), cluster 2 with anthropometrics (i.e., S) and cluster 3 with a high hydrodynamic profile (i.e., CDa). The variable that seems to discriminate better the clusters was the dv/v (F=53.680; P<0.001), followed by the dv (F=28.506; P<0.001), CDa (F=21.025; P<0.001), S (F=6.297; P<0.01) and v (F=5.375; P=0.01). Stepwise discriminant analysis extracted 2 functions: Function 1 was mainly defined by dv/v and S (74.3% of variance), while function 2 was mainly defined by CDa (25.7% of variance). It can be concluded that kinematics, hydrodynamics and anthropometrics are determinant domains to classify and characterize young swimmers’ profiles.

The Interaction between Intro-Cyclic Variation of the Velocity and Mean Swimming Velocity in Young Competitive Swimmers


The aim of this study was to assess the relationship between the intra-cyclic variation of the horizontal velocity (dv) and the velocity of the 4 competitive swimming techniques in young swimmers. 45 young swimmers performed a set of maximal 4 × 25 m (freestyle, backstroke, breaststroke and butterfly stroke) swims with in water start. A speed-meter cable was attached to the swimmer's hip. The dv and the swimming velocity were analyzed. Within-subject tests presented significant variations in the dv based on the swimming technique. Post-hoc test revealed significant differences across all pair-wised swimming techniques (P<0.001), except for the comparison between freestyle and backstroke (P=0.98). The dv was higher in the breaststroke, followed by the butterfly, the backstroke and the freestyle. The quadratic models had the best goodness-of-fit and the lower error of estimation for the relationship between the dv and the swimming velocity in all swimming techniques (0.24 ≤ R(2) ≤ 0.51). As a conclusion, there is a non-linear relationship where the increase of swimming velocity leads to a decrease of dv in young competitive swimmers.
Shoulder Rotator Cuff Balance, Strength, and Endurance in Young Swimmers during A Competitive Season


The purpose of this study was to analyze the effects of a competitive swim season on the strength, balance, and endurance of shoulder rotator cuff muscles in young swimmers. A repeated measures design was used with 3 measurements performed during the swim season. A swimmers group (n = 20) of young men with no dry land training and a sedentary group (n = 16) of male students with the same characteristics (age, body mass, height, and maturational state) were evaluated. In both groups, the peak torque of shoulder internal rotator (IRt) and external rotator (ERt) was assessed during preseason, midseason (16 weeks), and postseason (32 weeks). Concentric action at 60 and 180°·s was measured using an isokinetic dynamometer. The ER/IR strength ratios and endurance ratios were also obtained. At 60°·s, there were significant training effects in the IRt strength and ER/IR ratio on both shoulders. This trend was the same throughout the competitive season. The same trend was present at 180°·s because the training effects are seen primarily in IRt and ER/IR ratios. With respect to endurance ratios, within-group data were similar in ERt and IRt for both shoulders, with no significant differences between moments. However, between-group differences occurred mostly in the IRt. Results suggest that a competitive swim season favors the increase of muscular imbalances in the shoulder rotators of young competitive swimmers, mainly because of increased levels of IRt strength and endurance that are proportionally larger than those of their antagonists. A compensatory strength training program should be considered.

Tracking the Performance, Energetics and Biomechanics of International versus National Level Swimmers during a Competitive Season


The purpose of this study was to track and compare the changes of performance, energetic and biomechanical profiles of international (Int) and national (Nat) level swimmers during a season. Ten Portuguese male swimmers (four Int and six Nat level subjects) were evaluated on three different time periods (TP(1), TP(2), TP(3)) of the 2009-2010 season. Swimming performance was assessed based on official time’s lists of the 200-m freestyle event. An incremental set of 7 × 200 m swims was applied to assess the energetic and biomechanical data. Measurements were made of: (1) velocity at the 4 mmol of lactate levels (V4), stroke index at V4 (SI@V4) and propelling efficiency at V4 (η(p)@V4), as energetic estimators; (2) stroke length at V4 (SL@V4) and stroke frequency at V4 (SF@V4), as biomechanical variables. The results demonstrated no significant variations in all variables throughout the season. The inter-group comparison pointed out higher values for Int swimmers, with statistical differences for the 200 m performance in all time periods. Near values of the statistical significance were demonstrated for the SI@V4 in TP(1) and TP(3). The tracking based on K values was high only for the SI@V4. It is concluded that a high stability can be observed for elite swimmers performance, energetic and biomechanical profiles throughout a single season. Int swimmers are able to maintain a higher energetic and biomechanical capacity than Nat ones at all times. The SI@V4 may be used as an indicator of performance variation.
The aim of this study was to develop a structural equation model (i.e., a confirmatory technique that analyzes relationships among observed variables) for young swimmer performance based on selected kinematic, anthropometric and hydrodynamic variables. A total of 114 subjects (73 boys and 41 girls of mean age of 12.31 ± 1.09 years; 47.91 ± 10.81 kg body mass; 156.57 ± 10.90 cm height and Tanner stages 1-2) were evaluated. The variables assessed were the: (i) 100 m freestyle performance; (ii) stroke index; (iii) speed fluctuation; (iv) stroke distance; (v) active drag; (vi) arm span and; (vii) hand surface area. All paths were significant (p < .05). However, in deleting the path between the hand surface area and the stroke index, the model goodness-of-fit significantly improved. Swimming performance in young swimmers appeared to be dependent on swimming efficiency (i.e., stroke index), which is determined by the remaining variables assessed, except for the hand surface area. Therefore, young swimmer coaches and practitioners should design training programs with a focus on technical training enhancement (i.e., improving swimming efficiency).

Stability of athletic performance is important for practitioners and coaches, since it allows the selection of appropriate training methods and prediction of ages for best results. We performed a longitudinal study of 1694 season-best performances of 242 elite-standard swimmers throughout their careers, from 12 to 18 years of age. Mean stability (descriptive statistics and one-way repeated-measures ANOVA, followed by a Bonferroni post-hoc test) and normative stability (Cohen's kappa tracking index and the Pearson correlation coefficient) were determined for seven consecutive seasons. Performance improvements in all events were observed (14.36-18.97%). Bonferroni post-hoc tests verified changes in almost all events assessed. Cohen's kappa demonstrated low stability (0.17-0.27) in relative performance. Pearson correlations only became high from 15 to 16 years in the 50-m and 100-m events, and from 16 to 17 years in the 200-m, 400-m, and 1500-m events. Our results show that: (a) swimmers should display a substantial improvement (14-19%) to become elite standard as adults, such as at 18 years; (b) 16 is the age at which the ability to predict adult performance increases markedly.

The biophysical determinants related to swimming performance are one of the most attractive topics within swimming science. The aim of this paper was to do an update of the "state of art" about the interplay between performance, energetic and biomechanics in competitive swimming. Throughout the manuscript some recent highlights are described: (i) the relationship between swimmer's segmental kinematics (segmental velocities, stroke length, stroke frequency, stroke index and coordination index) and his center of mass kinematics (swimming velocity and speed fluctuation); (ii) the relationships between energetic (energy expenditure and energy cost) and swimmer's kinematics; and (iii) the prediction of swimming performance derived from above mentioned parameters.
SELECTED PUBLICATIONS

Dose-dependent Responses of Myofibrillar Protein Synthesis with Beef Ingestion are Enhanced with Resistance Exercise in Middle-aged Men 95

Greater Stimulation of Myofibrillar Protein Synthesis with Ingestion of Whey Protein Isolate v. Micellar Casein at Rest and after Resistance Exercise in Elderly Men 95

Myofibrillar Protein Synthesis Following Ingestion of Soy Protein Isolate at Rest and After Resistance Exercise in Elderly Men 96

Resistance Exercise Enhances Myofibrillar Protein Synthesis with Graded Intakes of Whey Protein in Older Men 97

Hypergravity Resistance Exercise: The Use of Artificial Gravity as Potential Countermeasure to Microgravity 98

Time Course of Proteolytic, Cytokine, and Myostatin Gene Expression after Acute Exercise in Human Skeletal Muscle 98

Space Cycle: A Human-Powered Centrifuge That Can Be Used for Hypergravity Resistance Training 99

Proteolytic mRNA Expression in Response to Acute Resistance Exercise in Human Single Skeletal Muscle Fibers 100

Time Course of Myogenic and Metabolic Gene Expression in Response to Acute Exercise in Human Skeletal Muscle 100

Current Appointments
Assistant Professor
Coordinator, SSM Internship and Career Guidance

Research Interest
Integrative and Multidisciplinary Research on:
• Plasticity and Adaptive Mechanisms of Skeletal Muscle to Exercise, Ageing, Diseases, and Muscle Disuse and Unloading
• Metabolism and Sports Nutrition

Contact Information
Phone: 6790 3695
Email: yifan.yang@nie.edu.sg
Office location: NIE 5-03-26
Dose-dependent Responses of Myofibrillar Protein Synthesis with Beef Ingestion are Enhanced with Resistance Exercise in Middle-aged Men


Aging impairs the sensitivity of skeletal muscle to anabolic stimuli, such as amino acids and resistance exercise. Beef is a nutrient-rich source of dietary protein capable of stimulating muscle protein synthesis (MPS) rates in older men at rest. To date, the dose-response of myofibrillar protein synthesis to graded ingestion of protein-rich foods, such as beef, has not been determined. We aimed to determine the dose-response of MPS with and without resistance exercise to graded doses of beef ingestion. Thirty-five middle-aged men (59 ± 2 years) ingested 0 g, 57 g (2 oz.; 12 g protein), 113 g (4 oz; 24 g protein), or 170 g (6 oz.; 36 g protein) of (15% fat) ground beef (n = 7 per group). Subjects performed a bout of unilateral resistance exercise to allow measurement of the fed state and the fed plus resistance exercise state within each dose. A primed constant infusion of L-[1-(13)C]leucine was initiated to measure leucine oxidation and of L-[ring-(13)C(6)]phenylalanine was initiated to measure myofibrillar MPS. Myofibrillar MPS was increased with ingestion of 170 g of beef to a greater extent than all other doses at rest and after resistance exercise. There was more leucine oxidation with ingestion of 113 g of beef than with 0 g and 57 g, and it increased further after ingestion of 170 g of beef (all p < 0.05). Ingestion of 170 g of beef protein is required to stimulate a rise in myofibrillar MPS over and above that seen with lower doses. An isolated bout of resistance exercise was potent in stimulating myofibrillar MPS, and acted additively with feeding.

Greater Stimulation of Myofibrillar Protein Synthesis with Ingestion of Whey Protein Isolate v. Micellar Casein at Rest and after Resistance Exercise in Elderly Men


We aimed to determine the effect of consuming pure isolated micellar casein or pure whey protein isolate on rates of myofibrillar protein synthesis (MPS) at rest and after resistance exercise in elderly men. Healthy elderly men (72 (sem 1) years; BMI 26·4 (sem 0·7) kg/m²) were divided into two groups (n 7 each) who received a primed, constant infusion of L-[ring-¹³C₆]phenylalanine to measure MPS at rest and during 4 h of exercise recovery. Participants performed unilateral leg resistance exercise followed by the consumption of isonitrogenous quantities (20 g) of casein or whey. Blood essential amino acids and leucine concentration peaked 60 min post-drink and were greater in amplitude after whey protein ingestion (both, P < 0·05). MPS in the rested leg was 65 % higher (P = 0·002) after ingestion of whey (0·040 (sem 0·003) %/h) when compared with micellar casein (0·024 (sem 0·002) %/h). Similarly, resistance exercise-stimulated rates of MPS were greater (P < 0·001) after whey ingestion (0·059 (sem 0·005) %/h) v. micellar casein (0·035 (sem 0·002) %/h). We conclude that ingestion of isolated whey protein supports greater rates of MPS than micellar casein both at rest and after resistance exercise in healthy elderly men. This result is probably related to a greater hyperaminoacidaemia or leucinaemia with whey ingestion.
Background: Increased amino acid availability stimulates muscle protein synthesis; however, aged muscle appears less responsive to the anabolic effects of amino acids when compared to the young. We aimed to compare changes in myofibrillar protein synthesis (MPS) in elderly men at rest and after resistance exercise following ingestion of different doses of soy protein and compare the responses to those we previously observed with ingestion of whey protein isolate. Methods: Thirty elderly men (age 71 ± 5 y) completed a bout of unilateral knee-extensor resistance exercise prior to ingesting no protein (0 g), or either 20 g or 40 g of soy protein isolate (0, S20, and S40 respectively). We compared these responses to previous responses from similar aged men who had ingested 20 g and 40 g of whey protein isolate (W20 and W40). A primed constant infusion of L-[1-13 C]leucine and L-[ring-13 C6]phenylalanine and skeletal muscle biopsies were used to measure whole-body leucine oxidation and MPS over 4 h post-protein consumption in both exercised and non-exercised legs. Results: Whole-body leucine oxidation increased with protein ingestion and was significantly greater for S20 vs. W20 (P = 0.003). Rates of MPS for S20 were less than W20 (P = 0.02) and not different from 0 g (P = 0.41) in both exercised and non-exercised leg muscles. For S40, MPS was also reduced compared with W40 under both rested and post-exercise conditions (both P < 0.005); however S40 increased MPS greater than 0 g under post-exercise conditions (P = 0.04). Conclusions: The relationship between protein intake and MPS is both dose and protein source-dependent, with isolated soy showing a reduced ability, as compared to isolated whey protein, to stimulate MPS under both rested and post-exercise conditions. These differences may relate to the lower postprandial leucinemia and greater rates of amino acid oxidation following ingestion of soy versus whey protein.

Feeding stimulates robust increases in muscle protein synthesis (MPS); however, ageing may alter the anabolic response to protein ingestion and the subsequent aminoacidaemia. With this as background, we aimed to determine in the present study the dose-response of MPS with the ingestion of isolated whey protein, with and without prior resistance exercise, in the elderly. For the purpose of this study, thirty-seven elderly men (age 71 (sd 4) years) completed a bout of unilateral leg-based resistance exercise before ingesting 0, 10, 20 or 40 g of whey protein isolate (W0-W40, respectively). Infusion of l-[1-13C]leucine and l-[ring-13C6]phenylalanine with bilateral vastus lateralis muscle biopsies were used to ascertain whole-body leucine oxidation and 4 h post-protein consumption of MPS in the fed-state of non-exercised and exercised leg muscles. It was determined that whole-body leucine oxidation increased in a stepwise, dose-dependent manner. MPS increased above basal, fasting values by approximately 65 and 90 % for W20 and W40, respectively (P < 0·05), but not with lower doses of whey. While resistance exercise was generally effective at stimulating MPS, W20 and W40 ingestion post-exercise increased MPS above W0 and W10 exercised values (P < 0·05) and W40 was greater than W20 (P < 0·05). Based on the study, the following conclusions were drawn. At rest, the optimal whey protein dose for non-frail older adults to consume, to increase myofibrillar MPS above fasting rates, was 20 g. Resistance exercise increases MPS in the elderly at all protein doses, but to a greater extent with 40 g of whey ingestion. These data suggest that, in contrast to younger adults, in whom post-exercise rates of MPS are saturated with 20 g of protein, exercised muscles of older adults respond to higher protein doses.

The aims of this study were to 1) determine if hypergravity (HG) squats can produce foot forces similar to those measured during 10-repetition maximum (10RM) squats using weights under normal 1-G(z) condition, and 2) compare the kinematics (duration and goniometry) and EMG activities of selected joints and muscles between 10RM and HG squats of similar total foot forces. Eight men and six women [27 yr (SD 4), 66 kg (SD 10)] completed ten 10RM [83 kg (SD 23)] and 10 HG squats (2.25-3.75 G(z)). HG squats were performed on a human-powered short-arm centrifuge. Foot forces were measured using insole force sensors. Hip, knee, and ankle angles were measured using electrogoniometers. EMG activities of the erector spinae, biceps femoris, rectus femoris, and gastrocnemius were also recorded during both squats. All subjects were able to achieve similar or higher average total foot forces during HG squats compared with those obtained during 10RM squats. There were no differences in total duration per set, average duration per repetition, and goniometry and EMG activities of the selected joints and muscles, respectively, between 10RM and HG squats. These results demonstrate that HG squats can produce very high foot forces that are comparable to those produced during 10RM squats at 1 G(z). In addition, the technique and muscle activation are similar between the two types of squats. This observation supports the view that HG resistance training may represent an important countermeasure to microgravity.


The aim of this study was to examine the time course induction of select proteolytic [muscle ring finger-1 (MuRF-1), atrogin-1, forhead box 3A (FOXO3A), calpain-1, calpain-2], myostatin, and cytokine (IL -6, -8, -15, and TNF-alpha) mRNA after an acute bout of resistance (RE) or run (RUN) exercise. Six experienced RE (25 +/- 4 yr, 74 +/- 14 kg, 1.71 +/- 0.11 m) and RUN (25 +/- 4 yr, 72 +/- 5 kg, 1.81 +/- 0.07 m) subjects had muscle biopsies from the vastus lateralis (RE) or gastrocnemius (RUN) before, immediately after, and 1, 2, 4, 8, 12, and 24 h postexercise. RE increased (P < 0.05) mRNA expression of MuRF-1 early (3.5-fold, 1-4 h), followed by a decrease in atrogin-1 (3.3-fold) and FOXO3A (1.7-fold) 8-12 h postexercise. Myostatin mRNA decreased (6.3-fold; P < 0.05) from 1 to 24 h postexercise, whereas IL-6, IL-8, and TNF-alpha mRNA were elevated 2-12 h. RUN increased (P < 0.05) MuRF-1 (3.6-fold), atrogin-1 (1.6-fold), and FOXO3A (1.9-fold) 1-4 h postexercise. Myostatin was suppressed (3.6-fold; P < 0.05) 8-12 h post-RUN. The cytokines exhibited a biphasic response, with immediate elevation (P < 0.05) of IL-6, IL-8, and TNF-alpha, followed by a second elevation (P < 0.05) 2-24 h postexercise. In general, the timing of the gene induction indicated early elevation of proteolytic genes, followed by prolonged elevation of cytokines and suppression of myostatin. These data provide basic information for the timing of human muscle biopsy samples for gene expression studies involving exercise. Furthermore, this information suggests a greater induction of proteolytic genes following RUN compared with RE.

**Introduction:** This study represents the first step toward testing the hypothesis that hypergravity can be used as a unique resistance training modality for maintaining the health and function of skeletal muscle in microgravity. The primary objectives of this study were to use a human-powered short-arm centrifuge for the following: 1) to determine whether subjects could perform squats under hypergravity conditions without developing motion sickness or illusory motion; 2) to measure foot forces while performing squats under hypergravity conditions; and 3) to determine the mechanical power required to produce 1.5, 2.0, 2.5, and 3.0 Gz (head to foot) at the feet. **Methods:** Subjects (22 males and 19 females) performed 10 squats each at 1.5, 2.0, 2.5, and 3.0 Gz on a human-powered short-arm centrifuge, the space cycle. Foot forces during each squat were monitored using insole force sensors, and normalized to foot forces measured at 1 Gz (relative foot forces). **Results:** Illusory motion was minimized using a visual focal point, and did not affect the ability of subjects to perform squats. The mean standing relative foot forces at 3.0 Gz were 2.3 and 2.4 for the male and female subjects, respectively. The work rate required to power the space cycle was a linear function of Gz, and is well within the aerobic scope of untrained individuals. **Discussion:** The findings of this study demonstrate that hypergravity can be used as an effective modality for loading skeletal muscle and that subjects can perform squat resistance exercise without developing motion sickness or illusory motion.
The purpose of this study was to characterize changes in mRNA expression of select proteolytic markers in human slow-twitch [myosin heavy chain (MHC) I] and fast-twitch (MHC IIa) single skeletal muscle fibers following a bout of resistance exercise (RE). Muscle biopsies were obtained from the vastus lateralis of eight young healthy sedentary men [23 +/- 2 yr (mean +/- SD), 93 +/- 17 kg, 183 +/- 6 cm] before and 4 and 24 h after 3 x 10 repetitions of bilateral knee extensions at 65% of one repetition maximum. The mRNA levels of TNF-alpha, calpains 1 and 2, muscle RING (really interesting novel gene) finger-1 (MuRF-1), atrogin-1, caspase-3, B-cell leukemia/lymphoma (Bcl)-2, and Bcl-2-associated X protein (Bax) were quantified using real-time RT-PCR. Generally, MHC I fibers had higher (1.6- to 5.0-fold, P < 0.05) mRNA expression pre- and post-RE. One exception was a higher (1.6- to 3.9-fold, P < 0.05) Bax-to-Bcl-2 mRNA ratio in MHC IIa fibers pre- and post-RE. RE increased (1.4- to 4.8-fold, P < 0.05) MuRF-1 and caspase-3 mRNA levels 4-24 h post-RE in both fiber types, whereas Bax-to-Bcl-2 mRNA ratio increased 2.2-fold (P < 0.05) at 4 h post-RE only in MHC I fibers. These results suggest that MHC I fibers have a greater proteolytic mRNA expression pre- and post-RE compared with MHC IIa fibers. The greatest mRNA induction following RE was in MuRF-1 and caspase-3 in both fiber types. This altered and specific proteolytic mRNA expression among slow- and fast-twitch muscle fibers indicates that the ubiquitin/proteasomal and caspase pathways may play an important role in muscle remodeling with RE.

The aim of this study was to examine the time course activation of select myogenic (MRF4, Myf5, MyoD, myogenin) and metabolic (CD36, CPT1, HKII, and PDK4) genes after an acute bout of resistance (RE) or run (Run) exercise. Six RE subjects [25 +/- 4 yr (mean +/- SD), 74 +/- 14 kg, 1.71 +/- 0.11 m] and six Run subjects [25 +/- 4 yr, 72 +/- 5 kg, 1.81 +/- 0.07 m, 63 +/- 8 ml.kg(-1).min(-1)) were studied. Eight muscle biopsies were taken from the vastus lateralis (RE) and gastrocnemius (Run) before, immediately after, and 1, 2, 4, 8, 12 and 24 h after exercise. RE increased mRNA of MRF4 (3.7- to 4.5-fold 2-4 h post), MyoD (5.8-fold 8 h post), myogenin (2.6- and 3.5-fold 8-12 h post), HKII (3.6- to 10.5-fold 2-12 h post), and PDK4 (14- to 26-fold 2-8 h post). There were no differences in Myf5, CD36, and CPT1 mRNA levels 0-24 h post-RE. Run increased mRNA of MyoD (5.0- to 8.0-fold), HKII (12- to 16-fold), and PDK4 (32- to 52-fold) at 8-12 h postexercise. There were no differences in MRF4, Myf5, myogenin, CD36 and CPT1 mRNA levels 0-24 h post-Run. These data indicate a myogenic and metabolic gene induction with RE and Run exercise. The timing of the gene induction is variable and generally peaks 4-8 h postexercise with all gene expression not significantly different from the preexercise levels by 24 h postexercise. These data provide basic information for the timing of human muscle biopsy samples for gene-expression studies involving exercise.
SELECTED PUBLICATIONS

Creative Dance: Singapore Children’s Creative thinking and Problem-Solving Responses

Young Singaporeans’ Perceptions of Dance in Physical Education

GOH-LEONG Lai Keun M.A.

Current Appointments
Senior Lecturer
Coordinator, SSM Scholarship Matters
Coordinator, Staff Welfare Committee and Book Prizes

Research Interest
- Curriculum Gymnastics
- Dance Education
- Labanotation
- Health and Wellness

Contact Information
Phone: 6790 3694
Email: laikeunleong@nie.edu.sg
Office location: NIE 5-03-27
**Creative Dance: Singapore Children’s Creative thinking and Problem-Solving Responses**


An important outcome of Singapore’s education is the development of creative thinking skills. This project investigates the impact of a creative dance unit on a class of Primary One (seven year-old) children’s usage of bodily kinesthetic intelligence to solve problems. One key objective was for the researchers to observe something new, something that stimulated the children to deviate from their normal range of motion. Students were observed across five sessions in order to document any progressive learning, particularly in their kinesthetic responses to the problem-solving tasks. These kinesthetic responses serve as the primary data source for this paper. Our belief was that creative thinking and problem solving are learnable and teachable skills. We hypothesized that in spite of children’s lack of dance education, there would be observable increase in creative thinking as expressed in varied solutions to movement problems over the course of five sessions. A programme of instruction and curricular materials has been designed to support the acquisition of cognitive skills and subject-matter knowledge and increase students’ proficiency in problem solving and experimentation using the tools of dance.

**Young Singaporeans’ Perceptions of Dance in Physical Education**


This study explored the perceptions of young Singaporeans (13-17 years) regarding dance, especially the nature and purposes of dance in schools. It was drawn from a recent macro study of students’ experiences and views of physical education (PE), a dimension of which is dance education, and analysed in the light of stated objectives in the Singapore schools’ PE curriculum (Curriculum Planning and Development Division [CPDD], 2005). The purpose of the broad study was to identify, document and promote best practice in PE in three dimensions, games, dance and gymnastics, as contextualized across three levels of schooling (primary, secondary and pre-university) (McNeill, Lim, Wang, Tan, & MacPhail, 2009; Leong, 2012). This particular dimension focuses on adolescents (n=85), who provided data through focus group interviews conducted in two secondary (Sec) schools and two junior colleges (JC). The purpose is to give voice to students’ views in order to provide teachers and policy makers with insights into what dance is for the young people involved with the long-term aim of developing meaningful dance curricula.

*Keywords*: Dance education, perceptions, personal meanings, pedagogy, dance programme
SELECTED PUBLICATIONS

Bike Republic: An Essential Guide to Cycling in Singapore

Enhancing Teaching and Learning in the 21st Century: Using Videocasts and Online Resources as Self Directed Learning Tools

Bike for Tykes: A Fun, Practical Guide for Kids Learning to Cycle

Talent Identification and Talent Development in Singapore

A Holistic Approach to Managing Obesity and Fitness: The Raffles Experience

Talent Identification in Schools: The Raffles Experience

Mohammed Azhar Bin YUSOF
M.S.

Current Appointments
Senior Lecturer
Coordinator, Practicum Committee

Research Interest
• Pedagogy in Physical Education
• Rugby

Contact Information
Phone: 6790 3701
Email: azhar.yusof@nie.edu.sg
Office location: NIE 5-03-21
**Bike Republic: An Essential Guide to Cycling in Singapore**


Cycling is one of the fastest growing sport in Singapore. The significant increase in participation in cycling races an events bear evidence to this. With the government investing in infrastructure to improve, increase and support cycling as a sport and as a form of commuting, cycling in Singapore is set to grow further. This book is targeted at cycling enthusiasts who wish take up cycling as a sport. It draws from knowledge of sports science and experiences of established former and current national riders in road, off road and time trialing. Their advice are most valuable for any rider. The book includes training plans, maps and many more making it a truly essential guide to riding in Singapore.

**Enhancing Teaching and Learning in the 21st Century: Using Videocasts and Online Resources as Self Directed Learning Tools**


As we seek to develop our students to be self-directed learners, new media should be part of our teaching tools. 2 pilot studies (i) the use of videocasts on Youtube to complement the teaching and learning of rugby amongst trainee-teachers at NIE, and (ii) the use of videos and e-resources as self-directed learning tools to determine their effectiveness in improving physical fitness in an all-girls secondary school, are presented. The positive findings are worth examining further to see if similar positive results can be achieved in other contexts and schools.

**Bike for Tykes: A Fun, Practical Guide for Kids Learning to Cycle**


This book is a fun guide for children ages 5-8 who are learning to cycle. It offers useful advice on the basic aspects of cycling from choosing a bike to essential safety precautions and important dos and don’ts.
Many schools in Singapore engage in some form of talent detection and identification for the purpose of selecting students into sports CCA teams. If not done systematically and effectively, students may end up doing a sport that they may not have the potential for or worse that they do not any interest in. Subsequent talent development may result in improvement but would prove a big challenge if the students do not have the attributes of excel in the sport. The Raffles experience of talent identification shows how a systematic talent identification system can lead to more effective allocation of students to the sport that they have greater potential to do well in.

Managing overweight and obesity issues in school requires a multi-pronged approach to be effective. The Raffles approach includes having an effective PE programme, a personal and customized approach to each individual overweight/obese student, engaging and educating the parents to name a few. The Raffles experience is worth examining for its effectiveness. Their multi-pronged and holistic approach can be easily adopted in any school to achieve similar positive results.

In developing niche areas in sports, many schools have adopted various approaches to talent identification. The Raffles Talent Identification Programme (TIP) has achieved much success for the school as it provides an important first step in achieving success in sports. The screenings known as Psychomotor Profiling (PP) and Sports Profiling (SP) are administered to all new students to detect and identify sporting talents. The subsequent CCA Trail provides students with more information and knowledge about the various sports CCAs on offer for which they base their preference on. This choice and the results of PP and SP are put together to determine which sports CCA they students should be allocated to achieve optimal sports performance.
SELECTED PUBLICATIONS

The Slow Contagion of Scottish Example: Association Football in Nineteenth-Century Colonial Singapore

Sports and Games in Colonial Singapore: 1819-1867

Oldfield’s XI and the Golden Bond of Empire: The 1927 Australian Cricket tour of Singapore and Malaya

A Metamorphosis for Physical Education

When Girls become Women: Sport Socialization through Schools

Muslim Women and Dragon Boat Racing

Christianity & Sport: A Promising Combination

Celestials in Touch: Sport and the Chinese in Colonial Singapore

Nicholas Giles APLIN
Ph.D

Current Appointments
Senior Lecturer
Coordinator, Special Projects
OTE Enrichment Committee
Coordinator, Academic Quality Management (AQM) Committee

Research Interest
• Introduction to Physical Education and Sport
• Social History of Sport in Singapore
• Olympism
• Socio-Cultural Aspects of Sport
• Football
• Rugby
• Cricket
• Softball
• Squash
• Javelin
• International Chess
• Golf

Contact Information
Phone: 6790 3706
Email: nicholas.aplin@nie.edu.sg
Office location: NIE 5-03-16
The Slow Contagion of Scottish Example: Association Football in Nineteenth-Century Colonial Singapore


The Singapore Football Association was established in 1892. It was the first institution of its kind in Asia. Unlike the majority of sports and games that the British introduced to Singapore, only one really captured the imagination of the predominantly migrant population. Association football became the national game based on its appeal to a wider range of devotees. The game was introduced to the Straits Settlement by maritime engineers, many of whom were Scots, and their friends from the Singapore Cricket Club. Military personnel followed suit and garrison troops proved to be enthusiastic advocates and rivals. Initially interest in the game spread quickly to the other communal groups notably the minority indigenous Malay population and the Straits Chinese population, but then stalled as it lacked complete support from the colonial British. The game was transformed from a colonial distraction to a tool of cultural imperialism. The game was promoted as a civilizing agent, yet the reluctance of the Europeans in the Cricket Club to play football against the Chinese in the early years prevented more rapid growth. The activity was embraced by those who found the benefits of play to be appealing, and yet also ignored or resisted by those with other social objectives.

Sports and Games in Colonial Singapore: 1819-1867


It is generally agreed that the majority of sports and games that exist in Singapore today were brought by the British as colonial settlers. The first fifty years of colonial domination (beginning in 1819) provided a foundation for the spread of team games that occurred in the second half of the century. The pursuit of athleticism and the games ethic, associated with activities emerging from British Public Schools, would dominate the later sports scene in Singapore. With the added necessity of ensuring health and fitness to combat the tropical environment, games were gradually introduced to other sectors of the predominantly migrant population. This paper outlines the evolution of sport (often termed ‘amusements’ by the British settlers) within the context of rule by the British East India Company. Individual games and recreational pursuits were the rule of the day. The small British and European contingent brought with them the legacy of country games and traditional sport, meaning horse racing, hunting, shooting and to a lesser degree fishing. Not surprisingly sailing proved to be the first systematically organized outdoor activity. Indoor games such as billiards and chess also prevailed. The first organized open-air game was probably ‘fives’ – a relative of rackets and squash. Some indigenous games were present, notably sepak raga or ‘bulatan’. The first sports organized for the general population took place during the New Year festivities, when land and sea sports provided a rare occasion for the people to participate in boisterous fun.
Oldfield's XI and the Golden Bond of Empire: The 1927 Australian Cricket tour of Singapore and Malaya


Risking possible rebuke from the Australian Board of Control, Bert Oldfield and Charlie Macartney organised an extensive cricketing tour to Singapore and Malaya in 1927. Taking a strong team, including three other test players, the tour was an opportunity to enjoy a working holiday near the Equator. Singapore was a thriving trading centre for products such as tin and rubber from its hinterland – Peninsula Malaya. For the hosts the visit was heartily welcomed. It was an opportunity for merchants, planters and administrators to challenge some of the great names in cricket and to reinforce colonial connections through the medium of the game. No payment was anticipated by the tourists, just the assurance of effusive hospitality. The impact of the tour was short-lived. The entertainment value was immediate and substantial, but the opportunity to encourage greater Asian involvement in the game was overlooked. The Australians were full of praise for their hosts and, despite a packed itinerary, took pleasant memories away with them. However, this was to be the last of the ‘unapproved’ tours. In Singapore and Malaya the local cricketers basked briefly in the glow of moderate success achieved on the field, but they were unable to spark any significant interest in the game from an Asian population of predominantly Chinese and Malay origins.

A Metamorphosis for Physical Education


The slow but steady transformation of teacher training in physical education represented one of the most significant changes on the education landscape. Undervalued by the British during colonial days, the legacy gradually disappeared when PE pioneers returning from graduate programmes were able to convince the education fraternity that comprehensive and well-structured PE programmes were an integral and inherent part of an effective education system. The period between 1973 and 1991 marked a phase when key individuals were able to conceptualise and create a meaningful institution and craft a vibrant collective identity for PE in Singapore. The process successfully provided the momentum to propel PE away from its backwater berth to enter the turbulent mainstream.
When Girls become Women: Sport Socialization through Schools


The enduring colonial tradition that women in Singapore seldom participated in sport has been slow to dissolve. However, the nature and rate of positive change in the values that guide decisions about involvement has become more pronounced in recent times. Women are becoming more active and some would say even more successful than men in the competitive arena. The formalization of Physical Education, as part of the school curriculum, has stimulated greater awareness and facilitated greater exposure for girls to a domain that had otherwise been neglected. Women have become more prepared to enter sports usually characterized as male dominated, for example contact team sports. This paper examines the shift in prioritization of values amongst Singapore’s sporting females. Information gained from a small-scale survey and two interviews with sportswomen in national contact sport teams, provides a framework to explore these trends and the process of empowerment of females in sport. This paper provides an insight into the motivating factors for women’s sports participation, the significance of the school sports experience and the accompanying implications.

Muslim Women and Dragon Boat Racing


In multi-racial Singapore sports are often characterized by the promotion of inclusive participation. All racial groups are encouraged to participate, none are excluded. Moving beyond the functional value of sport – a perspective which views team activities as facilitating social cohesion – potential pitfalls along the path to harmonious engagement in sport can be identified. Individuals and groups may find an activity attractive, yet deeper cultural beliefs and values may keep people apart. In women’s activities no one is excluded, but in some activities there remains a dominance of one group over the others. There exists a low level of involvement by Muslim women in dragon boat racing. As the first record of dragon boating identifies the sport as being dominated by Chinese men, this finding is not surprising. There are indications that the numbers of Muslim women participating will increase, but currently, even among the younger generation there are barriers. With the aid of informal interviews, this paper attempts to put into perspective possible factors (relating to culture, motivation and team identity) that might deter some Muslim women from participating in dragon boat racing as a sport. The paper concludes with a note on suggestions for future research.
Christianity & Sport: A Promising Combination


Intertwining the relationship between Christianity and sports, the relevance of its salience on the sports culture has been a milestone in the development of sports in the last 150 years. This paper examines concepts associated with the role of Christian ideals and the evolution of modern sports. Early ideas of Muscular Christianity provide a backdrop for an examination of contemporary issues relating to the significance of Christianity with current sporting practices. Modern sport has moved beyond the traditional notions of Muscular Christianity espoused passionately by Thomas Arnold at Rugby School and later by George Edward Lynch Cotton at Marlborough College during the middle of the 19th century to a more globalized form of games ethics whereby Christianity is being integrated into a whole new dimension. The purpose of this study is to examine and measure the influences of Christianity on the sports culture; understanding the implications of the direction of sports towards a more professional and commercial era. Interviews were conducted with sportsmen and coaches to gain insights and perspectives into their views on this topic.

Celestials in Touch: Sport and the Chinese in Colonial Singapore


Stamford Raffles created Singapore as an equatorial emporium. Those who followed his lead from Britain were guided by imperialist values and beliefs. They created a sporting culture that assigned the indigenous population and the vast tide of migrants to the sidelines for over fifty years. Segregation and discrimination in recreation and amateur sport characterized the European need for amusement and release from colonial tedium. Sport belonged to different world for the many other cultural groups who had found their way to Singapore. However, the marginal involvement of indigenous Malays, Indians, and, the Chinese – who represented by far the largest group – was only partly imposed by the European minority. The preference of many was to observe, either with indifference or with a gambler’s rapt attention. A greater attraction to sport emerged before the beginning of the twentieth century, with an acceleration during the pre-Great War period. Mixed cultural and national affiliations fuelled by economic progress then brought about a boom that reached its peak in the 1930s. In the case of the Chinese population of Singapore, the desire to keep pace with modern sport and exercise practices was matched by an inherent need to keep in touch with the motherland.
SELECTED PUBLICATIONS

Testing of Badminton Shuttles with a Prototypelauncher

Why do High Jumpers Use a Curved Approach?

TAN Cher Chay, John Ph.D

Current Appointments
Senior Lecturer
Coordinator, Publicity and Website (PESS and SSM)
Coordinator, Staff Welfare Committee

Research Interest
- Anatomy
- Sport Biomechanics
- Racquet Games
- Track & Field

Contact Information
Phone: 6790 3688
Email: john.tan@nie.edu.sg
Office location: NIE 5-03-35
Testing of Badminton Shuttles with a Prototypelauncher


In most prestigious badminton tournaments, shuttles are tested before they can be deemed ‘fit’ for use. Currently, testing of shuttles is done manually where the players of a competition project the test shuttle with a full underhand stroke hit with an upward angle. According to the International Badminton Federation Laws (2005), the shuttle from the serve test should traverse a horizontal distance between 12.41 and 12.87m to be deemed fit for use. This approach is very subjective. The aim of this study is to provide an objective alternative for testing of shuttles. A prototype launching device was built for testing of shuttle cocks in badminton. Using kinematic approach in motion analysis, the flight characteristics of the shuttles were analysed to test the projection capability of the launching device. The ability to discriminate the quality of shuttles was also compared with that of the traditional approach. The results showed the prototype launching device was capable of discriminating quality shuttles as compared to the traditional approach. The launcher was consistent in projecting shuttles with similar flight characteristics.

Keywords: Badminton shuttles, shuttle launchers, shuttle testing, kinematic approach

Why do High Jumpers Use a Curved Approach?


The curved approach in High Jump presents some clear advantage although there is no general agreement upon the mechanism or the mechanics. To determine the characteristics of the approach curve and to investigate how it contributes to the generation of somersault rotation, a simple theoretical model was used to demonstrate that a tightening approach curve would change the inward lean towards the centre of the curve into outwards lean. Three-dimensional video analysis was conducted on performances of two elite male high jumpers in competition. It was found that in each case the radius of the approach curve and the inward lean angle both decreased towards the end of the approach (p < 0.01). The amount of outward lean angular velocity generated was shown to be a major proportion of the required somersault angular velocity for a jump. It was concluded that the main advantage of a curved approach was that it resulted in the generation of somersault velocity providing the curve tightened towards the end of the approach.

Keywords: High jump, curved approach, somersault rotation, biomechanics
SELECTED PUBLICATIONS

Empirical Investigations of Nonlinear Motor Learning

‘How Does TGfU Work?’: Examining the Relationship Between Learning Design in TGfU and A Nonlinear Pedagogy

Children’s Perspectives on Conceptual Games Teaching: A Value-Adding Experience

Moving Towards Quality Physical Education: Physical Education Provision in Singapore

Structuring Time and Questioning to Achieve Tactical Awareness in Games Lessons

TAN Wee Keat, Clara Ph.D.

Current Appointments
Senior Lecturer
Assistant Head (Teaching)
Coordinator, Time Table

Research Interest
- Children’s Perception of Physical Education
- Teaching Games for Understanding and Achievement Motivation in Sport and PE Settings

Contact Information
Phone: 6790 3705
Email: clara.tan@nie.edu.sg
Office location: NIE 5-03-17
Empirical Investigations of Nonlinear Motor Learning


Skill acquisition can be conceived as a nonlinear, emergent process punctuated by sudden changes in skill capability and coordination dynamics stability. The rate of learning when expressed in terms of movement dynamics typically follows nonlinear trajectories interspersed throughout practice with trial-to-trial fluctuations. In this review we present recent empirical evidence examining both individual learners and also groups or teams of learners, which serve to further illuminate the nonlinear nature of skill acquisition. Innovative experimental designs, and sophisticated data collection / analysis tools are common features of this rapidly expanding body of literature. Finally, we present a number of practical implications for consideration within sport and physical activity pedagogy in the 21st century. The key role of physical educators is to design tasks and games that provide learners with opportunities to explore and find movement solutions within a set of specific constraints (especially task constraints).

Keywords: Coordination dynamics, variability, pedagogy, skill acquisition
Background: In the last few decades, conceptions about teaching and learning in physical education have evolved from a teacher-centred approach to a more student centred approach where learners are encouraged to develop problem-solving skills, critical thinking and autonomy of thought. A popular model advocating this approach in physical education, Teaching Games for Understanding (TGfU), has attracted widespread attention. Although advocates of TGfU have provided some empirical and anecdotal evidence to support the ‘tactical over technical approach’ to games teaching, recent work has highlighted that to date, the question ‘Does TGfU work?’ has remained largely unanswered. Therefore, there is a need to research the intuitive assumptions about how students learn to play games and to understand how the TGfU approach might work for games teaching and learning.

Purpose: The purpose of this paper is to provide insights to further our understanding of the possible processes underpinning the pedagogical principles of TGfU in games teaching. In this regard, we outline how a Nonlinear Pedagogy approach could provide a theoretical rationale to explain how the principles of TGfU might support learning design for games teaching. To achieve this aim, we examined the viability of the four key pedagogical principles of the TGfU model and highlighted the theoretical and practical implications of Nonlinear Pedagogy, considered with some empirical evidence from the motor learning literature.

Findings: The theoretical ideas emanating from an ecological dynamics perspective, such as constraints manipulation, importance of maintaining information-movement coupling and harnessing movement variability, can underpin a Nonlinear Pedagogy approach. It has been proposed that research evidence from the motor learning literature can provide a suitable theoretical grounding to support the viability of the four main pedagogical principles of the TGfU model (i.e., sampling, tactical complexity, representation and exaggeration) and can contribute insights to the possible processes of TGfU in games teaching.

Summary: A Nonlinear Pedagogy approach has the potential to provide researchers and physical educators with an understanding of the theoretical and practical work on TGfU, in association with its pedagogical principles. Understanding the underlying processes linked to the key pedagogical principles in learning design is critical for addressing pedagogy and curriculum concerns in physical education to enhance student learning. The ideas raised in this paper provided some rationale for the efficacy of the model, and also a platform for researchers and practitioners to more effectively engage students using the TGfU model.

Keywords: TGfU, pedagogical principles, nonlinear pedagogy, learning design, physical education
Children’s Perspectives on Conceptual Games Teaching: A Value-Adding Experience


Background: Revisions of the Singaporean physical education (PE) syllabus in 1999 and 2006 included a conceptual approach to teaching games. The games concept approach (GCA), a form of constructivist pedagogy, was a distinct departure from the direct teaching methods traditionally used in the country. Following the GCA’s introduction into a PE teacher education programme, a study was undertaken the use of the approach. Aims: This study evaluates the GCA from the perspective of children in lessons taught by student teachers (STs). The purpose was to determine whether or not those children saw the GCA as adding value to their PE experiences and the nature of any perceived added value. Method: The study took place in Singaporean government primary schools, where according to their usual PE teachers, the children (n = 297) had had no previous GCA teaching. The children experienced between 7 and 12 GCA lessons taught by one of seven STs. A survey was administered about those experiences at the end of the games unit. Data were collected through an open-ended questionnaire. Specifically, the children were asked to compare the GCA lessons with their prior PE (taught by their usual teacher). Their views were also sought on the perceived quality of the games unit: its focus, its most- and least-liked aspects (with explanations for those feelings) as well as specifics of what they thought they had learnt during the lessons. The survey responses were open-coded using analytical induction techniques, and then reduced through a typology of Fullan’s four images of students and educational change: (a) heightened interest and engagement with learning; (b) temporary escape from boredom; (c) indifference; and (d) confusion. Results: From over 90% of the children, there were strong indications of a perceived departure from their usual PE. In terms of Fullan’s framework, (a) the GCA was received with heightened interest and a perceived pedagogical shift was interpreted to add value to the children’s PE experiences. Their perceived outcomes fell into one of three main categories: games skills, games understanding and social cohesion and each of these had a number of elements. In a minority of cases (10%), the GCA lessons were experienced less favourably. In those cases, the GCA unit seemed (b) merely to give relief from the tedium of the children’s ‘traditional’ PE lessons; and/or (c) was ‘boring’. Unfortunately, (d) some children were also unsure about the GCA’s purpose and voiced confusion about aspects of the ‘new’ pedagogy. Some children associated those indifferent lessons with their ST’s lack of efficacy. Conclusions: It was found that the children generally saw that the GCA had positive impact by adding value to their PE experiences, through processes and outcomes that were seen to be different from those of their prior PE. However, there were also negative indications in the findings and these highlighted deficiencies in the way that STs had used the approach. The implications from the findings are that, from the children’s perspective, the GCA is worth pursuing as a games pedagogy, but action is warranted in PE teacher preparation in order for children to experience maximum gains under the guidance of STs.

Keywords: Perspectives; children; games; tactical pedagogy; Singapore

This study investigated the provision of physical education (PE) in Singapore. Singapore is a small island city state of approximately 699 square kilometres with a population of about 4 million people. This article aims to highlight the current status of PE in Singapore schools and compare it against suggested international standards and recommendations. From questionnaires distributed to every school on a voluntary basis, 164 Heads of Department (HODs) from 78 primary schools, 74 secondary schools and 12 junior colleges, and 474 teachers from 170 schools responded. The findings from these questionnaires focused on the impact of facilities, staffing, timetabling, curriculum time and status, on the provision of PE. In relation to the international context, Singapore faces similar constraints such as inadequate facilities and equipment, and insufficient allocation of time. The study makes a strong case for the improved status and function of PE in schools but three main issues require further attention: (i) primary schools are disadvantaged by staffing issues and general provision; (ii) PE lessons are both inadequate in number and duration to achieve the ‘desired outcomes’ of the PE syllabus; and (iii) class sizes are considered too large for meaningful learning to occur, resulting in teachers prioritising management issues. When these issues are addressed and their solutions translated into practice, Singapore can actualise the vision of making every student physically educated and achieve a world class standard.

Keywords: Physical education, provision of physical education, views and experiences
Structuring Time and Questioning to Achieve Tactical Awareness in Games Lessons


**Background:** A paradigm shift in educational policy to create problem solvers and critical thinkers produced the games concept approach (GCA) in Singapore's Revised Syllabus for Physical Education (1999). A pilot study (2001) conducted on 11 primary school student teachers (STs) using this approach identified time management and questioning as two of the major challenges faced by novice teachers. **Purpose:** To examine the GCA from three perspectives: structure--lesson form in terms of teacher-time and pupil-time; product--how STs used those time fractions; and process--the nature of their questioning (type, timing, and target). **Participants and setting:** Forty-nine STs from three different PETE cohorts (two-year diploma, four-year degree, two-year post-graduate diploma) volunteered to participate in the study conducted during the penultimate week of their final practicum in public primary and secondary schools. **Intervention:** Based on the findings of the pilot study, PETE increased the emphasis on GCA content specific knowledge and pedagogical procedures. To further support STs learning to actualise the GCA, authentic micro-teaching experiences that were closely monitored by faculty were provided in schools nearby. **Research design:** This is a descriptive study of time-management and questioning strategies implemented by STs on practicum. Each lesson was segmented into a number of sub-categories of teacher-time (organisation, demonstration and closure) and pupil-time (practice time and game time). Questions were categorised as knowledge, technical, tactical or affective. **Data collection:** Each ST was video-taped teaching a GCA lesson towards the end of their final practicum. The STs individually determined the timing of the data collection and the lesson to be observed. **Data analysis:** Each lesson was segmented into a number of sub-categories of both teacher- and pupil-time. Duration recording using Noldus software (Observer 4.0) segmented the time management of different lesson components. Questioning was coded in terms of type, timing and target. Separate MANOVAs were used to measure the difference between programmes and levels (primary and secondary) in relation to time-management procedures and questioning strategies. **Findings:** No differences emerged between the programmes or levels in their time-management or questioning strategies. Using the GCA, STs generated more pupil time (53%) than teacher time (47%). STs at the primary level provided more technical practice, and those in secondary schools more small-sided game play. Most questions (58%) were asked during play or practice but were substantially low-order involving knowledge or recall (76%) and only 6.7% were open-ended or divergent and capable of developing tactical awareness. **Conclusions:** Although STs are delivering more pupil time (practice and game) than teacher-time, the lesson structure requires further fine-tuning to extend the practice task beyond technical drills. Many questions are being asked to generate knowledge about games but lack sufficient quality to enhance critical thinking and tactical awareness, as the GCA intends.

**Keywords:** Games teaching, PETE, tactical awareness, constructivism, lesson structure, time management and questioning
SELECTED PUBLICATIONS

Motivational Profiles of Junior College Athletes: A Cluster Analysis

CHIAN Lit Khoon
Ph.D.

Current Appointments
Lecturer

Contact Information
Phone: 6790 3769
Email: litkhoon.chian@nie.edu.sg
Office location: NIE 5-03-03F
Motivational Profiles of Junior College Athletes: A Cluster Analysis


The purpose of the study was to identify the motivational profiles underlying sport participation among young Singapore college athletes, as well as to examine the relationships between motivational profiles and a range of cognitive, affective and behavioral indices. Junior college athletes (N = 303, mean age = 17.64, SD = .60) completed a questionnaire assessing achievement goal orientations, self-determination, sport ability beliefs and perceived competence, and other motivational indices. Four meaningful clusters were identified and validated with differences in perceived motivational climates and other variables. The use of cluster analysis in the present study proved fruitful in identifying subgroups of athletes with differentiated motivational patterns. Consequently, the information obtained could assist coaches in designing intervention programs that target the athletes’ motivational needs.

Keywords: Achievement goals, sport ability beliefs, self-determination, motivational profiles, cluster analysis
SELECTED PUBLICATIONS

Foucault’s Archaeological Discourse Analysis on the Innovative Changes of the Primary Physical Education Structure in Singapore 122

A Foucauldian Analysis as to Discourse on Physical Education Classes from the Eyes of Elementary Pre-service Teachers in the Field of Teaching Practicum 123

Collaborations and Strategies of Government and Interagency Working Groups related to the Policies of Primary Physical Education in Singapore 124

The Association between Participation in Leisure Sports Activities of Married Couples and Marital Satisfaction 125

The Condition and Background of the Socio-cultural Discourse Formed among Elementary Pre-service Teachers Wearing Soccer Replica 126

The Relationship between the School Physical Education Policy and the Structure of the Discourse of Elementary Physical Education 126

Elementary School Teachers’ Value Culture Discourse on Physical Education and their Exercise Practice 127

The First Winter Season at a Ski-Club: An Ethnographic Study on the Socialization Process of Novice Skiers 128

CHUNG Ho Jin
Ph.D.

Current Appointments
Lecturer
Coordinator, Website and Publicity

Research Interest
- Sociology of Sport
- Michel Foucault
- Discourse Analysis
- Physical Education in Public Schools
- Sports Policy
- Teaching Games for Understanding
- Racket and Ball Games

Contact Information
Phone: 6790 3776
Email: hojin.chung@nie.edu.sg
Office location: NIE 5-03-34

The purpose of this study was to reveal the innovative changes of the primary physical education structure in Singapore using the archaeological discourse analysis which is based on Foucault's thoughts and books. In order to achieve this purpose, data was collected through documents, media and press materials, and in-depth interviews and the following conclusions were obtained. First, the discourses which conduced to the innovative changes of the primary physical education structure in Singapore was formed by the power status of subject: the historical knowledge structure of Singapore's institute of teacher education, the educational policy structure which is government-dominant, and the implementation structure for Singapore government to support primary physical education. Second, the details of the innovative changes of the primary physical education structure in Singapore were comprised of the institutional emplacements of subject: balancing knowledge with skills and values, increasing quality teacher assignment and physical education classes, expanding and enhancing infrastructure. Third, the discourses produced by the innovative changes of the primary physical education structure in Singapore consisted of social circumstances of subject: paradigm shift of stakeholders surrounding Singapore's primary physical education, expansion of institutional support in budget allocation on Singapore's primary physical education, and reflection of social situation according to the innovative changes of the primary physical education structure in Singapore.

*Keywords:* Foucault's archaeological discourse analysis, innovative change, primary physical education structure in Singapore
A Foucauldian Analysis as to Discourse on Physical Education Classes from the Eyes of Elementary Pre-service Teachers in the Field of Teaching Practicum


The purpose of this study was to reveal the discourse on physical education classes which are faked/made in the field of practicum and which are seen/hidden from the eyes of elementary pre-service teachers around demonstration classes and actual classes using a Foucauldian Analysis. In order to achieve this purpose of the study, data was collected through practicum diaries and in-depth interviews in terms of what was seen, heard, and spoken. In relation to the data analysis and interpretation, the Foucauldian Analysis method was used to analyze collected data based on the Foucault's genealogical discuss and archaeological discuss; and then Foucault’s discourse theory was applied to interpret and reinterpret the results of analyses. The main results of this study are suggested by two specific research questions as follows: First, what is the discourse on physical education classes which are faked in the field of practicum and which are seen from the eyes of elementary pre-service teachers? The discourse on physical education classes faked in the field of practicum and seen from the eyes of elementary pre-service teachers were largely for-show-classes, curriculum-abiding classes, difficult-to-watch or observe classes, and controlled classes. Second, what is the discourse on physical education classes which are made in the field of practicum and which are hidden from the eyes of elementary pre-service teachers? The discourse on physical education classes made in the field of practicum and hidden from the eyes of elementary pre-service teachers were largely free-ride classes, abnormal operation of curriculum, classes replaced by major subjects, negotiated classes.

Keywords: Practicum, student teaching, practicum field, elementary pre-service teacher, eyes of elementary pre-service teacher, physical education class, discourse of physical education class, foucauldian analysis
The purpose of this study was to reveal what is the substance of the policies on primary physical education in Singapore, how the government and interagency working groups have organically collaborated to consistently develop the policies and how they have come up with strategies and have implemented them in details and to suggest a direction of a primary physical education policy of Korea based on Singapore’s best practices. In order to achieve this purpose of the study, data was collected through documents of government, academic articles and newspapers and analysed by the review of literatures. The main results of this study are as follows:- Firstly, the policies of primary physical education in Singapore have focused on managing balanced educational curriculums and programmes, strengthening manpower of teachers and professional educators, and building strategic infrastructures. Secondly, the government and interagency working groups related to the policies of primary physical education in Singapore have organically collaborated and strategically implemented their policies through formation of steering committee, priority compilation of a budget, reinforcement of institutional supports among ministers and relevant government offices. Thirdly, the recommendations of a policy direction for Korea based on Singapore’s best practices are to form the school physical education expert committee driven by the government, to secure a reasonable budget for normal operations of physical education curriculums, and to establish national institute for school physical education.

*Keywords*: collaboration, strategy, government, interagency working groups, policy, primary physical education, Singapore

The purpose of this study was to examine the association between participation in leisure sports activities of married couples and marital satisfaction. In order to fulfill such purpose, the population was set as married adults with more than 1 year of marriage, living in Seoul. Using the method of multi-stage stratified cluster random sampling, 600 participants were randomly sampled: 150 participants from a Culture and Sports Center in each of the selected 4 autonomous districts respectively (Gangdong: Gangdong-gu, Gangseo: Guro-gu, Gangnam: Gangnam-gu, Gangbuk: Jongno-gu). Although 583 participants responded, only 567 were used for data analyses because 16 were considered to be incomplete or insincere responses. The survey questionnaire was used to collect the data. The questionnaire to measure marital satisfaction as one of variables in this study was the MSS(Marital Satisfaction Scale) questionnaire; based on Chung(2001)’s research, we have revised Yoo(1991)’s measuring tool which was customized to make it relevant to the Korean socio-cultural environment and which had basically consisted of 48 sentences that Roach et al.(1981) selected according to item discrimination power from the 180 MSI(Marital Satisfaction Inventory) questions that were first developed by Snyder(1979). From the analyses of data, this study found out the following results: First, there were partial differences in marital satisfaction of couples on a basis of socio-demographic characteristic variables. Particularly, marital satisfaction differed according to gender, age, occupation, religion, educational level, monthly average income, age gap from spouse, duration of marriage, marriage style, and number of children. Second, participation in leisure sports activities of married couples influenced marital satisfaction. The results of this study supported that the sub-variables of marital satisfaction which comprise of companionship, emotion, communication, sexual affection, attitude, and self-consciousness are associated with form of participation and degree of participation.

*Keywords:* Leisure, leisure sports activities, participation in leisure sports activities of married couples, marital satisfaction
The Condition and Background of the Socio-cultural Discourse Formed among Elementary Pre-service Teachers Wearing Soccer Replica


The purpose of this study was to discuss the condition and background of the socio-cultural discourse formed among elementary pre-service teachers wearing soccer replica. In order to achieve the objective of the study, research was conducted using dept-interview and media/press data, and documents which are related to soccer or discourse. The method of an archaeological discourse analysis in accordance with Foucault (1969) was used to analyze collected data. In addition, Foucault’s discourse theory was applied to interpret consolidated data. The main results of the thesis are summarized as follows:-First, what is the condition of the socio-cultural discourse formed among elementary pre-service teachers wearing soccer replica? It was found that the condition consists of 1) Identification and vicarious satisfaction: 'I want to be one of them’, 2) Self-satisfaction and a social superiority feeling: 'I feel good being superior to others’, 3) Aspiration to be different: 'This is the way to present myself that is one of a kind’, and 4) A sense of belonging and unity: 'I am feeling part of the team that I support’. Second, what is the background of the socio-cultural discourse formed among elementary pre-service teachers wearing soccer replica? From this study, the background was determined to be 1) Power of europe football league system – football pyramid, 2) Commercialization of soccer – creating commercial products surrounding soccer stadiums, 3) Symbiosis between the press and soccer – strategic agreements/relationship with the press, and 4) Culture of cheering for a soccer team – enthusiasm of supporters who tend to organize a social group.

Keywords: Soccer replica, elementary pre-service teachers, condition of the socio-cultural discourse, background of the socio-cultural discourse

The Relationship between the School Physical Education Policy and the Structure of the Discourse of Elementary Physical Education


The purpose of this study was to discuss the relationship between the school physical education policy and the structure of the discourse of elementary physical education from the Foucault's archaeological perspective. The data was collected by official documents, government publications and academic articles. The collected data was analyzed by the method of the archaeological discourse analysis of Foucault (1969). The main results of this research are as follows: First, the authority structure of school physical education policy consists of the policies and procedures of Ministry of Education, Science and Technology, name changes of the sports policy related government organizations and the division in relation to school physical education policy. Second, the elementary physical education discourse includes body of knowledge of elementary physical education, social situation surrounding elementary physical education, evidences and contents of existence of elementary physical education and diffractive characteristic of elementary physical education.

Keywords: School physical education policy, structure of discourse of elementary physical education, archaeology
The purpose of this study was to discuss elementary school teachers’ value culture discourse on physical education and their exercise practice. The data was collected by administrative agency materials and educational institution materials, media and press and in-depth interviews. The collected data was analyzed by the method of Foucault’s archaeological discourse analysis. The main results of this research are the followings. First, the objects of the discourse are formed by the contents of the value of elementary physical education, the structure of authority that defines the value of elementary physical education, the socio-cultural background of the value of elementary physical education. Second, the subject of the discourse is placed by people who are given the status that allows them to speak about the value of elementary physical education, the legitimate places of the value of elementary physical education, the social situation of elementary physical education. Third, the concepts of the discourse are established by the contents of value evidence, the relationship amongst value evidence, the interaction of value evidence of elementary physical education. Fourth, the strategies of the discourse are formed by the incompatibility of the value of elementary physical education, the reasons why incompatibility takes place, the relationship of value culture discourse between elementary physical education and other elementary subjects. Fifth, there is no clear relationship between awareness of the value of physical education and exercise practice. The teachers' exercise is only for their health and the gap between the two represents the value culture discourse.

*Keywords:* Elementary teachers, elementary physical education, value culture discourse, exercise practice, discourse analysis

The purpose of this study was to discuss the socialization process of novice skiers. In doing so, an ethnographic study methodology was applied. The data was collected by participant observations, in-depth interviews amongst participants and documents. The collected data was analyzed by the method of an ethnographic study of Spradley (1980). The socialization process was consisted of five stages: preliminary, beginning, conflict, adaptation and growth stages. First, the preliminary stage is the first stage of the socialization process of novice skiers. In this stage, novice skiers prepare for official club activities. Second, the beginning stage is the second stage of the socialization process of novice skiers. Novice skiers begin to participate in the official club activities at the beginning stage. Third, the conflict stage is the third stage of the socialization process of novice skiers. Novice skiers show various and complex conflicts by participating in ski-club activities. Fourth, the adaptation stage is the fourth stage of the socialization process of novice skiers. Novice skiers overcome various conflicts and accept the unique culture of the ski-club. Fifth, the growth stage is the fifth stage of the socialization process of novice skiers. Novice skiers become a genuine member of the ski-club and look forward to the next winter season.

*Keywords:* Ski-club, novice skiers, first winter season, socialization process, ethnographic study
SELECTED PUBLICATIONS

Cross-Modal Rate of Perceived Exertion and Self-Regulated Exercises in Singaporean Male Adolescents

THOR Dianna
Ph.D

Current Appointments
Lecturer
Advisor, PESS and SSM
Coordinator, SSM Internship and Career Guidance

Research Interest
• Perceived Exertion and the use of Perceptual Scales during Sports
• Obesity and Exercise
• Health and Wellness
• Training and Performance
• Genetic Studies

Contact Information
Phone: 6790 3685
Email: dianna.thor@nie.edu.sg
Office location: NIE 5-03-38
Purpose: In this study, a comparison of ratings of perceived exertion (RPE) [undifferentiated (RPE-overall) and differentiated (RPE-Legs, and RPE-Chest)] that correspond to the ventilatory breakpoint (V_{pt}) between different exercise modes (cycling and walking/running) using the Children’s OMNI Scale of Perceived Exertion was investigated. A response normalized rating of perceived exertion (RPE) that corresponds to the V_{pt} in 13- to 17-year-old male adolescents was identified. An estimation-production paradigm was used to determine whether the adolescents could self-regulate intensity on a cycle ergometer and treadmill exercise using a prescribed target RPE, discriminate between target RPEs and produce intermittent RPEs in both ascending and descending sequence.

Methods: Participants were randomly assigned into cycling and walking/running groups and underwent one orientation trial (O), one estimation trial (E) and two production trials (P). During O, each participant’s peak oxygen uptake (VO_{2peak}) was determined using a progressive multi-stage cycle ergometer protocol for cycling participants and a modified Astrand treadmill protocol for walking/running participants. Oxygen uptake (VO2) and heart rate (HR) were recorded at the end of each stage of exercise. During E, undifferentiated (RPE-Overall) and differentiated RPE (RPE-Legs, RPE-Chest) were estimated and VO_{2} and HR were taken at every stage of a progressive cycle ergometer or treadmill test. Participants performed the exercise trials in O and E to volitional exhaustion. Significance for all statistical analysis was set at $P < 0.05$, unless otherwise stated. During P, participants adjusted the brake force on the cycle ergometer or speed on the treadmill to produce either an RPE sequence of 4 and 6 (ascending) or 6 and 4 (descending) in the 8-minute intermittent production trials.

Results: Exercise mode effect was not observed for any descriptive or dependent variable. V_{pt} corresponded to 67.7% VO_{2peak} for the cycling group and 70.4% VO_{2peak} for the walking/running group. RPE-Overall-V_{pt} (mean cycling, 5.1; mean walking/running, 4.8), RPE-Legs-V_{pt} (mean cycling, 5.6; mean walking/running, 5.2) and RPE-Chest-V_{pt} (mean cycling, 4.4; mean walking/running, 5.2) did not differ between the two groups. Response normalized RPE-Overall-V_{pt} for male adolescents aged 13-17 years was identified at 5. VO_{2} did not differ between E and P at target RPE of 4 (1.59 versus 1.57 L.min^{-1}) and 6 (1.87 versus 1.79 L.min^{-1}). HR did not differ between E and P at a target RPE of 4 (152.4 versus 151.1 beats.min^{-1}) and 6 (167.1 versus 162.4 beats.min^{-1}). Both VO_{2} and HR were higher ($P < 0.01$) at target RPE-6 than -4. Responses were not affected by exercise mode or production sequence.

Conclusion: Undifferentiated and differentiated RPE-V_{pt} were similar between cycling and walking/running participants. A comparatively stable RPE-V_{pt} for 13- to 17-year old male adolescents indicates a group normalized perceptual response at RPE-5. Male adolescents were able to use the OMNI Scale to self-regulate short-duration intermittent cycle and treadmill exercise intensity. The responses support prescription congruence and intensity discrimination of exercise intensity in 13- to 17-year old male adolescents.
SELECTED PUBLICATIONS

Exercise and Coronary Heart Disease Risk Markers in South Asian and European Men

Saravanan Pillai ARJUNAN Ph.D

Current Appointments
Teaching Fellow
Coordinator, Physical Proficiency Test

Research Interest
• Exercise and Health
• Cardiovascular Disease

Contact Information
Phone: 6790 3714
Email: saravanan.a@nie.edu.sg
Office location: NIE 5-03-07
Exercise and Coronary Heart Disease Risk Markers in South Asian and European Men


**Purpose:** South Asians have a higher than average risk of CHD. The reasons for this are unclear, but physical inactivity and/or poor responsiveness to exercise may play a role. This study compared the effect of prior exercise on postprandial triacylglycerol (TAG), glucose, insulin, interleukin-6, and soluble intercellular adhesion molecule-1 concentrations in South Asian and European men. **Methods:** Ten healthy South Asian men (i.e., nine Indian men and one Pakistani man) and 10 healthy European men age 20 to 28 yr completed two 2-d trials (exercise and control) in a randomized crossover design. On the afternoon of day 1 of the exercise trial, participants ran on a treadmill for 60 min at approximately 70% of maximal oxygen uptake. Participants rested on day 1 of the control trial. On day 2 of both trials, participants rested and consumed high-fat (57% of energy content) test meals for breakfast (0 h) and lunch (4 h). Fourteen venous blood samples were collected from a cannula between 0 and 9 h for metabolic measurements. **Results:** Three-way ANOVA identified higher (P < 0.05) postprandial TAG and insulin concentrations in South Asian versus European men. Exercise lowered postprandial TAG and interleukin-6 and elevated soluble intercellular adhesion molecule-1 concentrations. An interaction effect indicated a greater decrease (22% vs. 10%) in TAG area under the concentration versus time curve after exercise in South Asian than in European men. **Conclusions:** Postprandial TAG and insulin responses to high-fat meals were elevated in these South Asian men, but acute exercise was equally, if not more, effective for reducing postprandial lipemia in South Asian than in European men.

*Keywords:* Cardiovascular disease, exercise, inflammation, physical activity, postprandial lipemia