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Spatial and temporal accuracy in baseball hitting

Takatoshi Higuchi¹, Tomoyuki Nagami¹, Nobuaki Mizuguchi¹, Hiroki Nakata², Kazuyuki Kanosue²

¹ Graduate School of Sport Sciences, Waseda University, Japan

² Faculty of Sport Sciences, Waseda University, Japan

Hitting a baseball is one of the most difficult skills in sport. Batters are required to exert both power and accuracy into their bat swings in order to make a good hit. In the present study, we focused on the accuracy and distinguished the relation of batter's ability in bat control, timing, and spatial perception to the actual hitting accuracy. Nine college baseball batters performed following three tasks. Task 1: hitting a fastball thrown by a pitching machine. Task 2: observing the same pitch as the task 1 and indicating the location of the pitch right after the ball passed home plate. Task 3: hitting a ball on a baseball tee with five different locations. The actual hitting accuracy was defined by subject's performance in the task 1, such as the rate of hitting a ball with the sweet zone of a bat (success rate(pitch)), average distance from the sweet spot of the bat to the ball center at the ball-bat impact (contact accuracy (pitch)), and the variability of the location of the ball-bat impact (contact precision (pitch)). Based on the subject's performance in the task 3, the bat

control was defined by the success rate (tee), contact accuracy (tee), and contact precision (tee). The difference in the location of the ball-bat impact in pitcher-to-catcher direction between the task 1 and the task 3 represents the subjects' ability in the timing. The preciseness in the distance from the bat's sweet spot and actual ball in the task 2 represents the spatial perception. There was significant correlation between the subjects' performance in the actual hitting accuracy and their ability in spatial perception ($p < 0.05$). However, no correlation was found in neither between the actual hitting accuracy and timing nor between the actual hitting accuracy and bat control. We concluded that the bat control and timing do not contribute to the difference in the trained batters' actual hitting accuracy. It is suggested that batters with superior ability in the actual hitting accuracy possess greater precision in the spatial perception and ability to make an accurate contact independent of the timing.

A successful polarized endurance training model programs characteristic of Chinese elite speed skaters

Hongjun Yu

Department of Physical Education, Tsinghua University, China

Purpose: To describe a successful programs characteristic of endurance training load in Chinese elite speed skaters.

Methods: Two years' (2004-05 and 05-06 seasons) endurance daily training load of the Chinese national speed skating team of ($N = 8$, with 5 males, 23 ± 2.2 yr., weight 72.3 ± 2.5 kg., competitive experience 8.8 ± 2.7 yr., 500-M time $\leq 35.8 \pm 2.1$ s; 3 females' corresponding information are 22 ± 3.1 yr, 70.1 ± 1.2 ., 7.9 ± 1.3 yr., 37.9 ± 1.1 s) were collected and analyzed. The load included training volume (calculated by minutes), training intensity measured by heart rate meter (Polar S600) and probable lactate analyzer (ARKRAY Lactate Pro), training and duration calculated by sessions. Their sport performances in the National Games, World Cup Games and Olympic Games during 2004-2006

years, as well as lactate data measured by ARKRAY Lactate Pro, were also collected and analyzed. 15 and 30 minutes after the competitions were measured by probable lactate analyzer (ARKRAY Lactate Pro).

Results: It was found that total training volume and duration (sessions) were similar across seasons (see table 1). However, the training intensity distribution was very different between two seasons: they performed threshold training model and polarized training model (see table 1).

All speed skater' performance had a great improvement. Compared with two seasons, all speed skaters' lactates measure after competition indicates that blood lactate had significantly decreased.

Season	Volume (min)	Duration (session)	* Intensity Distribution Zone%			BL15 min	BL30min	Performance 500m(s)
			$2 \leq \text{mmol/L}$	$2-4 \text{mmol/L}$	$\geq 4 \text{mmol/L}$			
Male								
2004-05	8,158 \pm 214	102 \pm 3.7	40.8 \pm 2.1%	53 \pm 3.2%	6.1 \pm 1.7%			
2005-06	8,764 \pm 342	97 \pm 5.4	84.4 \pm 4.8% *	5.4 \pm 3.2% *	10.8 \pm 1.9% *	8.6 \pm 3.4% \downarrow *	4.6 \pm 1.8% \downarrow *	4.4 \pm 1.3% \uparrow *
Female								
2004-05	7,342 \pm 132	101 \pm 3.3	42.1 \pm 3.4%	49.8 \pm 1.5%	7.8 \pm 1.4%			
2005-06	7,548 \pm 173	98 \pm 6.4	87.1 \pm 4.4% *	4.8 \pm 2.5% *	8.9 \pm 1.6% *	10.3 \pm 2.2% \downarrow *	8.9 \pm 2.3% \downarrow *	5.3 \pm 2.7% \uparrow *

Note: BL15min=blood lactate after competition, \downarrow =decrease, \uparrow =increase * =intensity distribution of percent of total volume. * Statistically significantly different between two years, $p < 0.05$

Conclusion: Compare with two seasons training load in Chinese top-level speed skaters, the

result shows endurance training intensity distribution in polarized training model may attribute the improvement of speed skaters' aerobic ability and may improve the speed skaters' performance.

Efficacy of the injury prevention program on collegiate football teams -Two years randomized prospective study-

Yasuaki Saho¹, Toru Fukubayashi²

¹Graduate School of Sports Sciences, Waseda University, Japan

²Faculty of Sport Sciences, Waseda University, Japan

The aim of this prospective-randomized study was to investigate the efficacy of the injury prevention program on collegiate football teams.

【Study 1 and 2】

One-hundred eighty two collegiate male football players participated for study 1, and 93 players were selected for study 2. Players were assigned to either an intervention groups (The11 or The11+ α), or control group. The two training programs were conducted once or twice a week for 6 months. The11 is consisted ten exercises for core stability, lower extremity strength, balance and agility. The11+ α is focused on plyometrics training and slightly different from The11. Both programs take only 15-min. Incidence rates were denoted per 1000 player-hours (PH) for study 1. Using several field tests (Sprint, Pro-agility, Bounding, and Star Excursion Balance Test), each subject's physical fitness level was evaluated prior to training as well as six months after training for study 2. For both training groups, incidences were significantly lower than control group ($p < 0.05$). Pro-agility time was significantly improved in both training groups ($p < 0.05$), but not in control group ($p > 0.05$). Balance ability was significantly improved in only The11 group ($p < 0.05$).

【Study 3】

Ten players were selected from The11 group. The players were required to perform 3 maneuvers; a straight run, a sidestep cutting, and

a crossover cutting, under two different conditions; anticipated and unanticipated. For this study, only the side-step cutting was analyzed. Using a target board with three LED, subjects were given cues for 1 of the 3 tasks in both the anticipated and unanticipated conditions. Subjects received the cue before the trial, for the anticipated trials. During unanticipated trials, subjects received visual cue approximately 500 msec before reaching step position. They performed these maneuvers prior to training as well as six months after training. Three dimensional motion analysis system was used to measure knee and trunk motion during tasks. We analyzed each variable at the time of 100msec before foot contact, the time of foot contact, and the peak value at stance phase and compared before and after training. During anticipated task, the peak value of knee abduction angle after training was lower than before training. During unanticipated task, tibial internal rotation angle after training was lower than before training. Trunk orientation angles were not significant difference between before and after training.

Conclusions

The results of this study indicated that The11 and The11+ α programs have benefit not only to reduce the injury incidence but also improve physical fitness. And The11 program has potential to change the knee motion to avoid the severe knee injuries.

The response of adipokines/ myokines to acute and chronic high intensity interval training

Melanie Leggate

School of Sport, Exercise and Health Sciences, Loughborough University, England

Recent evidence suggests that low volume high intensity sprint interval training can improve glucose control and reduce insulin resistance in sedentary males after 2 weeks (Babraj et al. 2009 *BMC Endocr Disord*). Insulin resistance has been shown to be causatively linked to the elevation of cytokines and chronic low grade inflammation underpins many diseases. A number of exercise modalities have been shown to result in an acute inflammatory response, but also to reduce resting levels of a number of inflammatory biomarkers with exercise training (e.g. Thompson et al. 2010 *J Appl Physiol*). The first and most significant of these acute elevations in cytokines is IL-6, which then triggers a cascade of anti-inflammatory responses. The data presented, compares the IL-6/IL-6 receptor response to moderate continuous (MOD) and high intensity intermittent (HIIT) exercise, as well as some preliminary analysis of the mechanisms involved in the interaction between HIIT and the inflammatory response.

We have shown that the acute increase in IL-6 after a single bout of exercise is greater with HIIT than MOD matched for total work done due to an increased release of IL-6 from the working muscles. We then investigated the effects of 6

bouts of HIIT over 2 weeks on the inflammatory profile of 12 obese/ overweight males. Resting blood and subcutaneous adipose tissue (AT) samples were taken, before and after 2 weeks HIIT and a number of inflammatory biomarkers were quantified in plasma and AT. Preliminary findings, suggesting that repeated HIIT might be useful in targeting populations with elevated systemic inflammation, such as type 2 diabetes mellitus (T2DM) will be presented.

In parallel to these studies and as part of a study to phenotype T2DM in young adults we have to date collected samples from 5 young adults with T2DM (age 25.7 ± 3.1 y; BMI 37.5 ± 3.7 $\text{kg} \cdot \text{m}^{-2}$) and 5 lean controls (age 25.4 ± 3.5 y; BMI 23.3 ± 3.2 $\text{kg} \cdot \text{m}^{-2}$). This preliminary data has shown that relative $\dot{V}\text{O}_{2\text{peak}}$ was greater in the lean subjects ($p < 0.01$) and there was a tendency for the T2DM patients to have higher circulating levels of IL-6 ($p = 0.09$), TNF- α ($p = 0.08$) and C-reactive protein ($p = 0.09$), as well as a tendency for Vitamin D deficiency in T2DM ($p = 0.058$).

In conclusion, HIIT elicits a high acute inflammatory response after exercise and we are currently investigating how this affects chronic levels using a 2 week intervention.

Muscular strength is associated with metabolic risk independently of abdominal adiposity in Japanese women.

Tomoko Aoyama¹, Meiko Asaka¹, Toshimichi Ishijima², Hiroshi Kawano², Zhen-Bo Cao²,
Shizuo Sakamoto², Izumi Tabata³, Mitsuru Higuchi²

¹ Graduate School of Sport Sciences, Waseda University, Japan

² Faculty of Sport Sciences, Waseda University, Japan

³ Faculty of Sport and Health Science, Ritsumeikan University, Japan

Background: Metabolic syndrome (MeS) is a cluster of visceral obesity, hypertension, glucose intolerance, and dyslipidemia that substantially increases the risk of cardiovascular disease. Both low fitness (cardiorespiratory fitness (CRF) and muscular strength) and increased adiposity have been recognized as important risk factors associated with MeS. Low fitness and excess body fat often occur in combination. Therefore, we examined whether CRF and muscular strength are associated with individual and clustered metabolic risk factors independently of abdominal adiposity in Japanese people.

Methods: The subjects were 110 women and 110 men aged 20-69 years. Waist circumference (WC) was measured and the area of visceral fat was assessed by MRI. CRF was assessed by a maximal graded exercise test on a cycle ergometer and quantified as maximal oxygen uptake ($\dot{V}O_2\text{max}$). Muscular strength was evaluated by measuring hand grip strength (HGS). Systolic blood pressure (SBP), diastolic blood pressure (DBP), triglycerides (TG), HDL cholesterol (HDL-C), and fasting plasma glucose (FPG) were assessed and the sums of the z scores

for each individual risk factor were calculated (zMeS).

Results: $\dot{V}O_2\text{max}$ was significantly correlated with TG, HDL-C, DBP, and zMeS in men ($P < 0.05$) and with TG, SBP, DBP, FPG, and zMeS in women ($P < 0.01$). HGS was negatively correlated with FPG and zMeS in women ($P < 0.01$), but no significant correlations were obtained between HGS and any of the metabolic risk factors or zMeS in men. Multiple linear regression analysis revealed that $\dot{V}O_2\text{max}$ was inversely associated with TG in men ($P < 0.05$) and HGS was negatively associated with FPG and zMeS in women (FPG: $P < 0.001$, zMeS: $P < 0.05$), independently of WC. Adjusting for visceral fat instead of WC, similar results were obtained in women (FPG: $P < 0.01$, zMeS: $P < 0.05$), but the association between $\dot{V}O_2\text{max}$ and TG in men was attenuated to nonsignificant.

Conclusions: This study demonstrates that muscular strength is inversely associated with FPG and clustered metabolic risk factors independently of abdominal adiposity in Japanese women, but not in men.

Vibration training exerts neuroprotective effects on the substantia nigra dopaminergic neurons in Parkinson's disease model of mice

Ms. Li Zhao

Department of Exercise Physiology, Beijing Sport University, China

Parkinson's disease (PD) is a progressive disease with a variety of symptoms such as the increased resistance, slowness of movement, hypokinesia and akinesia and so on. PD patients also typically develop a stooped posture and may lose normal postural reflexes, leading to falls. The central pathological feature of PD was the loss of dopaminergic neurons in the substantia nigra. Recent studies from several laboratories have shown that exercise can have a beneficial effect in patients with PD or in rodent models of PD. Moreover random whole-body vibration could improve postural stability in PD, but the underlying molecular mechanisms responsible for these effects are poorly understood. Studies in rodent models provide a means to examine the effects of vibration on dopaminergic neurotransmission. Here, using low amplitude vibration training we determined on potential compensatory changes of tyrosine hydroxylase (TH) in the number of substantia nigra neurons and changes in dopamine levels (DA) and brain-derived neurotrophic factor (BDNF) in the striatum of the 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-lesioned mouse. C57BL/6J mice were divided into four groups: (1) saline, (2) MPTP, (3) MPTP plus low frequency vibration training, and (4) MPTP plus high frequency vibration training. Low amplitude vibration training was started 7 d after MPTP lesioning and continued

for 4 W. After the vibration training, immunohistochemical staining analysis of substantia nigra tyrosine hydroxylase showed that the numbers of TH immunoreactive cells in low frequency vibration training group and high frequency vibration training group were significantly higher compared with those in the MPTP; the numbers were not significantly different between the two group and saline group; and the numbers in MPTP were significantly decreased expression compared with saline group. Using HPLC, we found there was an increase in striatal dopamine in MPTP plus low frequency vibration training or MPTP plus high frequency vibration training mice compared with MPTP mice. Of course there was a significant decrease detected in MPTP mice compared with saline mice. Analyses using ELISA showed in striatal BDNF levels there was a decrease in MPTP mice only, no difference was found among the other three groups mice. These results suggest that low amplitude vibration training may lead to improvement in motor performance through adaptive changes of the basal ganglia circuitry, that is beneficial to the survival of dopaminergic neurons in the substantia nigra of PD mice, therefore resulting in increased dopamine levels in striatum. And the one of mechanism might be related to the up-regulation of BDNF expression in striatum.

Joint association of physical activity and screen time with overweight and its socio-demographic correlates among Japanese adults

Yung Liao¹, Kazuhiro Harada^{1,2}, Ai Shibata³, Kaori Ishii³, Koichiro Oka³, Yoshio Nakamura³,
Shigeru Inoue⁴, Teruichi Shimomitsu⁴

¹ Graduate School of Sport Sciences, Waseda University, Japan

² Research Fellow of the Japan Society for the Promotion of Science, Japan

³ Faculty of Sport Sciences, Waseda University, Japan

⁴ Department of Preventive Medicine and Public Health, Tokyo Medical University, Japan

Obesity and overweight are associated with an increased risk of morbidity from chronic diseases. Thus, identifying effective strategies for preventing weight gain would be a public health priority in many countries. Both insufficient physical activity (IPA) and high screen time (HST) were independent risk factors for obesity and these two behaviors are often considered to interrelate. However, there have been few studies examining how the combination of these two behaviors may contribute to the risk of obesity or overweight. In addition, describing socio-demographic factors associated with both PA and ST is useful for identifying characteristics of higher at-risk population on chronic diseases. The present study examined joint association of IPA and HST with BMI status and its socio-demographic correlates among Japanese adults. Data were analyzed from 2,832 respondents by an internet-based cross-sectional survey. Self-reported socio-demographic variables, PA (IPAQ-SV), ST (TV viewing, internet use and video games) and BMI were obtained. According to the public PA guideline (meeting 150 minutes MVPA per week) and the median of ST (engaging in 1,260 minutes

ST per week), the respondents were categorized into four groups: sufficient PA (SPA)/low ST (LST), sufficient PA/high ST, insufficient PA/low ST, and insufficient PA/high ST. The SPA/LST group was the referent group. Multinomial logistic regression analyses were utilized. The results showed that adults who engaged in IPA/HST were 1.48 times more likely to be overweight (BMI ≥ 25), compared with those with SPA/LST. Different socio-demographic correlates of PA/ST groups were also observed in SPA/HST, IPA/LST and IPA/HST group. Compared with SPA/LST group, adults who were older (aged 40-59), unmarried, without full-time job, and lower socio-economic status were more likely to engage in IPA/HST. Those who spend more time in ST behavior and were insufficiently active could have a higher risk of being overweight. Both promoting PA participation and reducing ST should target on these socio-demographic groups for decreasing the risks for being overweight.

Keywords: Socio-demographic correlates, physical activity, screen time, overweight