

科技部補助專題研究計畫成果報告 期末報告

運動訓練經驗對於鏡像神經元系統之調控—探討情緒辨識與運動競賽中預期能力的關聯性(第2年)

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計畫主持人：石佑翎
共同主持人：黃人珍
計畫參與人員：學士級-專任助理人員：孫愛奇
碩士班研究生-兼任助理人員：洪梓瑜
碩士班研究生-兼任助理人員：陳琇卿
碩士班研究生-兼任助理人員：林佳燕

報告附件：出席國際會議研究心得報告及發表論文

處理方式：

1. 公開資訊：本計畫涉及專利或其他智慧財產權，1年後可公開查詢
2. 「本研究」是否已有嚴重損及公共利益之發現：否
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中華民國 105 年 02 月 18 日

中文摘要：動作預期對開放式運動技能，如技擊運動，的成功表現有著關鍵性的影響。然而，在許多的影響動作預期的因素中，臉部情緒是否也提供了動作預期的相關線索目前仍未知。動作觀察網路(AON)被提出為動作預期的神經機制之一，其也曾被提出與社交網路(SN)有部分的重疊。因此，本研究假設跆拳道運動員的動作預期與情緒再認能力應有所關連。本實驗採用三個作業，包括跆拳道動作預期，臉部表情情緒再認與圖片按鍵控制作業，觀察跆拳道運動員與一般參與者間的行為與腦部活化差異。結果發現跆拳道運動員在預測跆拳道動作圖片的反應時間較一般參與者短，但對於情緒圖片預測的反應時間則與一般參與者無異。然而，跆拳道運動員相較於一般參與者，無論是在跆拳道動作預期或是臉部表情情緒再認的作業中，其前運動皮質區皆有較高的活化程度。本研究建議，前運動皮質對於動作預期與情緒辨識皆有重要的貢獻，而跆拳道訓練可增強其作用，所以跆拳道訓練對於動作預期與情緒辨識有著潛在的雙向促進效益。

中文關鍵詞：跆拳道，動作預期，人臉情緒

英文摘要：Action anticipation plays an important role in the successful performance of open skill sports, such as combat sports. However, less is known about if facial emotions have an influence on athletes' action anticipation skill in combat sports. The action observation network (AON) has been proposed as one of the neural mechanisms underpinning action anticipation. The existence of a close relationship between action anticipation and emotion recognition in taekwondo athletes was hypothesised. Three tasks, including action anticipation of taekwondo movements, the emotion recognition of facial expressions, as well as key pressing of scrambled pictures for movement control were used to investigate the differences in performance between taekwondo athletes and non-athletes. The pictures of the emotional facial expressions were taken from the Taiwanese Facial Expression Image Database (TFEID) (Chen and Yen, 2007). During fMRI scanning, the participants were asked to decide, as soon and as accurately as possible, whether the consequence of the action would be a front kick or a roundhouse kick for the taekwondo set or a happy or a fearful emotion for the facial expression set. The taekwondo athletes had significantly shorter reaction time than the non-athletic participants only for the taekwondo pictures, but not for the emotion pictures. The premotor cortex (BA6) was found yielding higher activity in the taekwondo athletes compared to the non-athletes for both action anticipation and emotion recognition. The premotor cortex, one of the core regions of the perception-action system, has been repeatedly shown to be activated during action imagery, imitation and anticipation. Premotor activations have also been found yielding greater

activations during emotion imitation than observation of emotion. In the present study, higher premotor activity was found in the taekwondo athletes than in the non-athletes for both emotion recognition and action anticipation may imply that the premotor cortex is crucial for both action and emotion understanding and its participation can be enhanced during taekwondo training. Hence, there could be a mutually beneficial effect between action anticipation and emotion recognition in taekwondo athletes.

英文關鍵詞： taekwondo, facial expression, action prediction

The relationship between action anticipation and emotion recognition in athletes of open skill sports

Introduction:

Action anticipation plays an important role in the successful performance of open skill sports, such as ball and combat sports. Most studies have targeted ball sports and agreed that information on body mechanics is one of the key determinants for successful action anticipation in open sports. However, less is known about combat sports, and whether facial emotions have an influence on athletes' action anticipation skill. Mounting evidence has supported the notion that action anticipation shares the same cortical areas as action observation. The action observation network (AON) has been proposed as one of the neural mechanisms underpinning action anticipation. Besides the AON, the social network (SN) is also implicated in action anticipation to understand the intentions behind the action of others. Hence, the existence of a close relationship between action anticipation and emotion recognition in taekwondo athletes was hypothesised. Furthermore, the neural substrates of the two experimental tasks were examined by fMRI to determine if emotion recognition plays a role in the action anticipation of taekwondo athletes.

Method:

Three tasks, including action anticipation of taekwondo movements, the emotion recognition of facial expressions, as well as key pressing of scrambled pictures for movement control were used to investigate the differences in performance between taekwondo athletes and non-athletes. Participants in the taekwondo athlete group (aged 19–23 years, mean of 20.8 years, SD of 1.4 years) were recruited from a professional sports university. None of the participants in the non-athlete control group (aged 19-23 years, mean of 20.9 years, SD of 1.2 years) had ever received any specific sports training. There were 12 participants (6 men and 6 women) in each group, and each participant provided written, informed consent prior to the experiment. The taekwondo movement pictures were extracted from videos of one male and one female taekwondo athlete performing front kicks and roundhouse kicks with various movement completeness. The pictures of the emotional facial expressions were taken from the Taiwanese Facial Expression Image Database (TFEID) (Chen and Yen, 2007). Pictures of one male and one female were chosen, and the faces depicted neutral, happy or fearful expressions. Pictures of various emotional intensities were produced using FaceMorpher (FaceMorpher, Luxand Inc.) by interpolating the prototypical happy or fearful expressions with the neutral face. These stimuli were presented against a black background on a 13" monitor using E-Prime software (E-Prime 2.0, Psychology Software Tools).

During fMRI scanning, the participants were asked to decide, as soon and as accurately as possible, whether the consequence of the action would be a front kick or a roundhouse kick for the taekwondo set or a happy or a fearful emotion for the facial expression set. The behavioural performances were analysed using a 2x2 analysis of variance (ANOVA) model by SPSS. Pre-processing and statistical analysis of MR images was performed by SPM8 (Statistical Parametric Mapping, Wellcome Trust Centre for Neuroimaging, London, UK), and the statistic threshold was set to uncorrected $p < 0.001$, with a spatial extent threshold of 10 voxels.

Results:

The taekwondo athletes had significantly shorter reaction time than the non-athletic participants only for the taekwondo pictures, but not for the emotion pictures (Figure 1). In terms of brain activations, significantly higher activations were found in taekwondo athletes compared to non-athletes, but not vice versa. The caudate nucleus was more activated in the taekwondo athletes than in the non-athletes when anticipating the outcome of taekwondo movements. Besides caudate nucleus, the premotor areas (BA6), cingulate gyrus (BA 23, 31), and the cerebellum also yielded higher activation in the taekwondo athletes than in the non-athletes for taekwondo pictures (Figure 2). For emotion pictures, significantly higher activations were found in the auditory and the premotor cortices for the taekwondo athletes than in

the non-athletes. A further conjunction analysis for the previous two contrasts was used to examine the common neural substrates for action anticipation and emotion recognition in taekwondo athletes. The premotor cortex (BA6) was found yielding higher activity in the taekwondo athletes compared to the non-athletes for both action anticipation and emotion recognition (Figure 3).

Discussions:

With comparable accuracy, the taekwondo athletes were found respond faster for only taekwondo pictures but not for emotion pictures. This finding is in line with previous studies showing superior performance of action anticipation in taekwondo athletes. This behavioural advantage were supported by higher activation in the caudate nucleus, the premotor areas (BA6), cingulate gyrus (BA 23, 31), and the cerebellum for the taekwondo athletes than for the non-athletes when anticipating the outcome of taekwondo movements. The caudate nucleus has been found critical for mediating implicit/procedural memory and updating the internal action representation. Hence, the higher caudate activation in the taekwondo athletes may signify a more sophisticated internal representation of taekwondo movements developed through years of training. The cerebellum also shows greater activity for pictures within the athletic-specific repertoire. It has been suggested that the cerebellum is implicated in controlling the acquisition of sensory information in

order to facilitate the processing efficiency. Therefore, the cerebellum may work in concert with the caudate nucleus to provide well-coordinated sensory information for updating action representation constantly during action anticipation. The conjunction analysis revealed the premotor cortex as the common region for both action anticipation and emotion recognition in taekwondo athletes. The premotor cortex, one of the core regions of the perception-action system, has been repeatedly shown to be activated during action imagery, imitation and anticipation. Premotor activations have also been found yielding greater activations during emotion imitation than observation of emotion. In the present study, higher premotor activity was found in the taekwondo athletes than in the non-athletes for both emotion recognition and action anticipation may imply that the premotor cortex is crucial for both action and emotion understanding and its participation can be enhanced during taekwondo training. Hence, there could be a mutually beneficial effect between action anticipation and emotion recognition in taekwondo athletes.

Key references:

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Repetitive TMS suggests a role of the human dorsal premotor cortex in action

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10.3389/fnhum.2012.00020

Figure 1

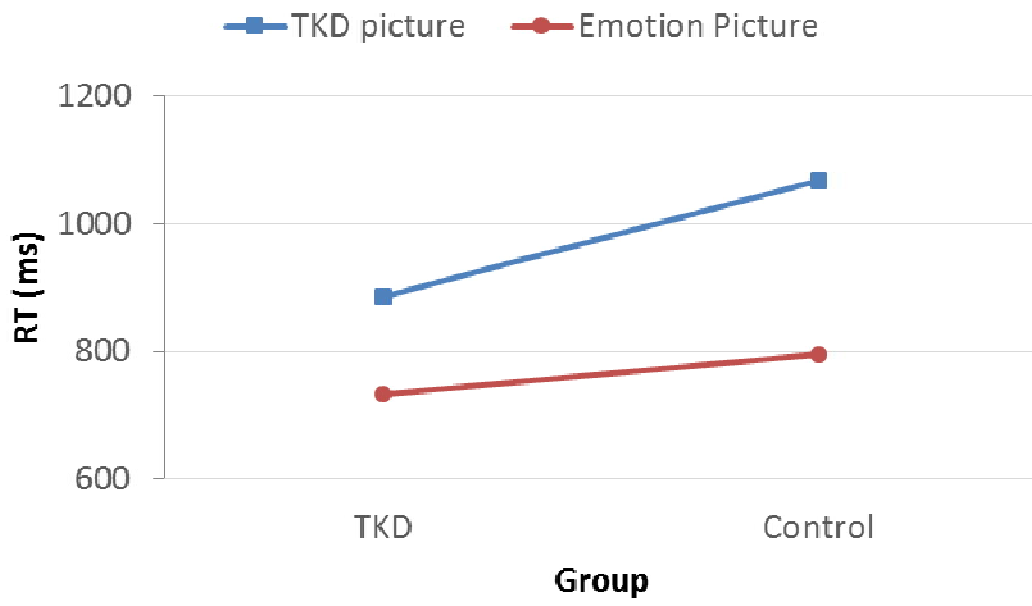


Figure 2 TKD > Control for TKD pictures

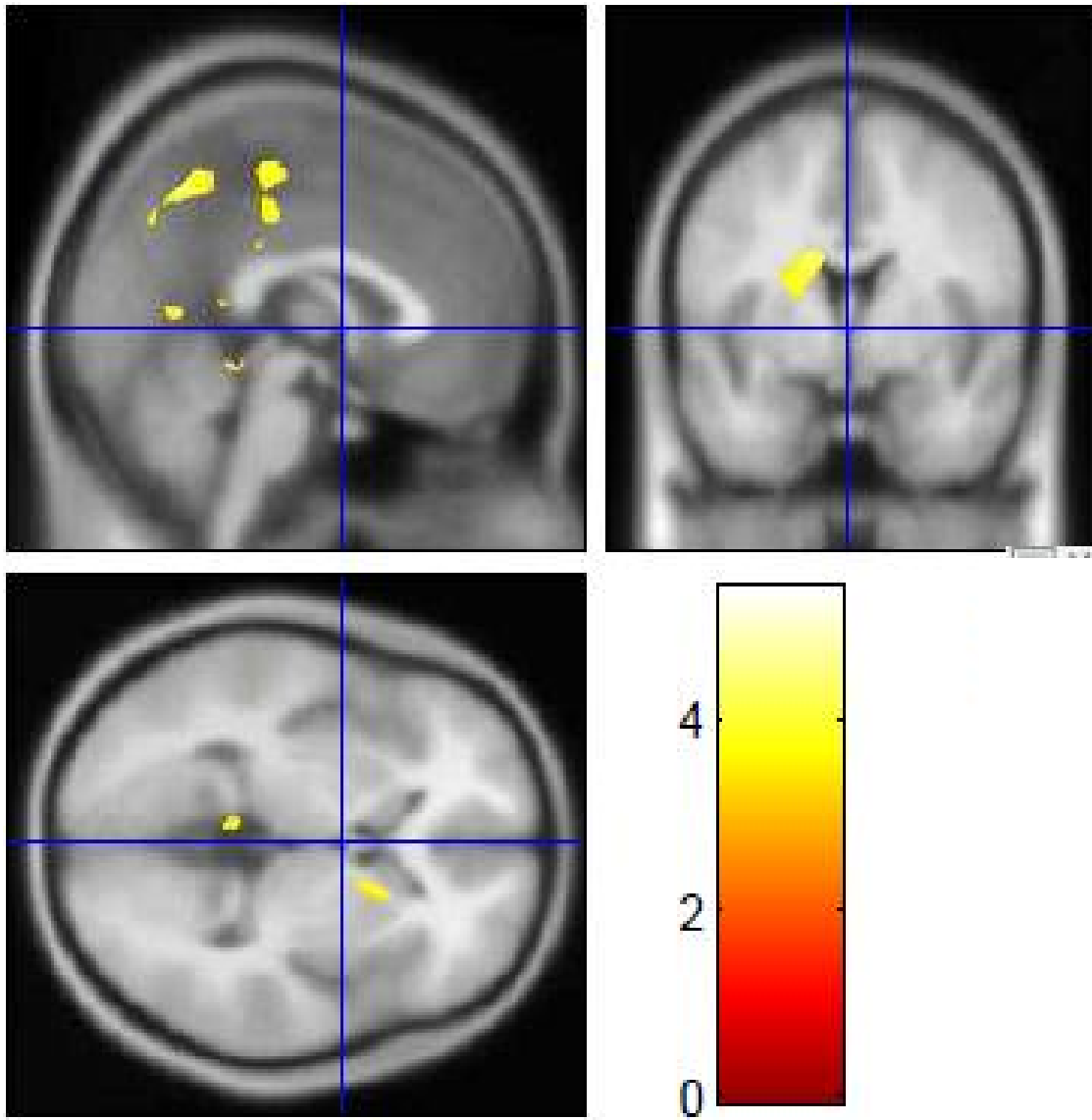
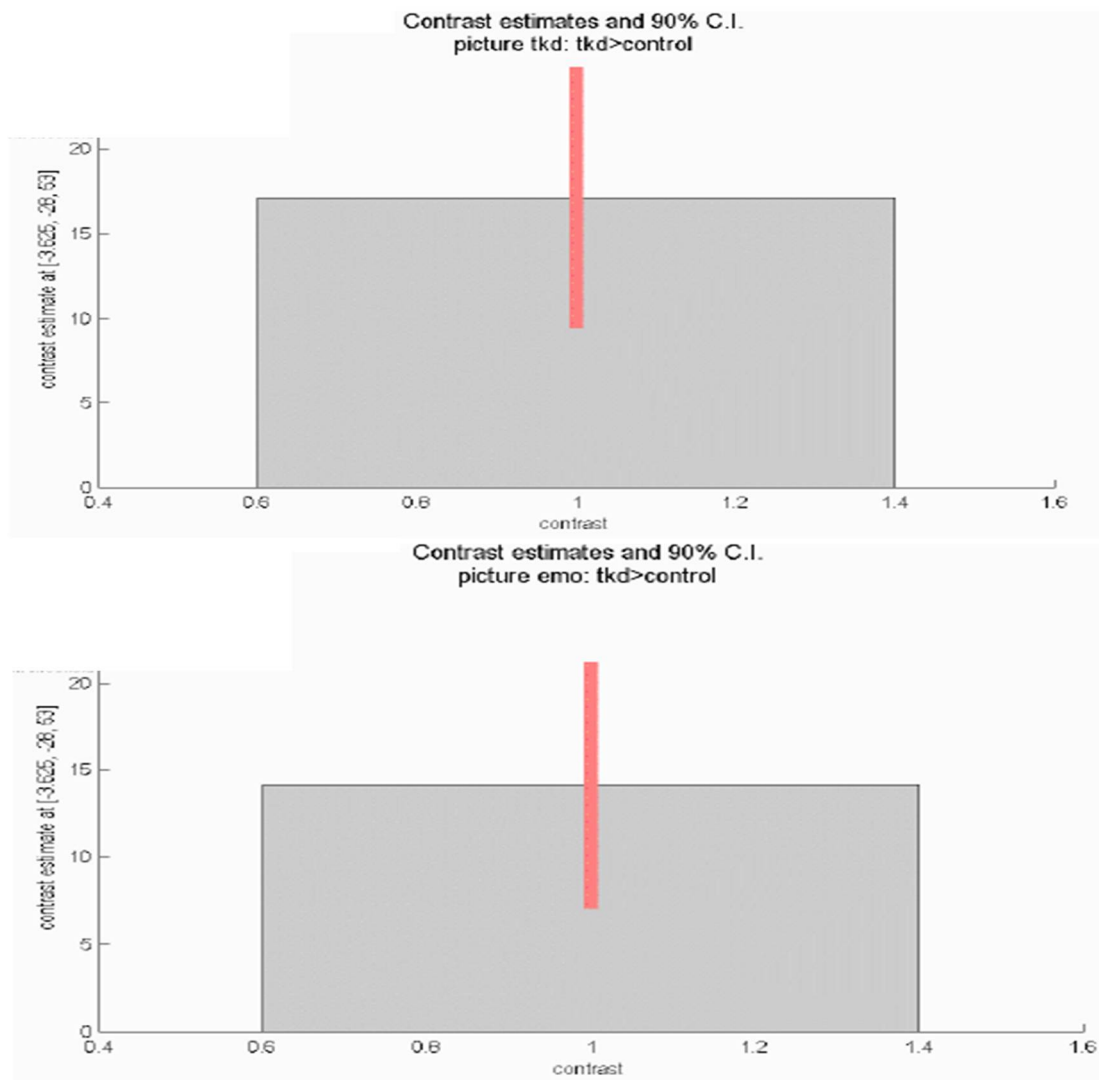


Figure 3 Contrast estimates for the common activation at [-4, -28, 53]



科技部補助專題研究計畫出席國際學術會議心得報告

日期：103 年 9 月 12 日

計畫編號	MOST 102-2420-H-028 -001 -MY2		
計畫名稱	運動訓練經驗對於鏡像神經元系統之調控— 探討情緒辨識與運動競賽中預期能力的關聯性		
出國人員 姓名	石佑翎	服務機構 及職稱	國立臺灣體育運動大學運動競技 學系
會議時間	103 年 7 月 2 日至 103 年 7 月 5 日	會議地點	荷蘭阿姆斯特丹
會議名稱	(中文)第 19 屆歐洲運動科學年會 (英文) The 19th Annual Congress of the European College of Sport Science		
發表題目	(中文)18 週排球訓練介入對體適能提升與視覺時間區辨能力之效益 (英文) Effects of 18 weeks volleyball training to improve physical fitness and visual temporal discrimination		

一、參加會議經過

本次會議除了邀請許多學者進行專題演講之外，也安排了許多場次的口頭報告。由於場次與主題眾多，故每場報告參與的學者不會太多，故在大會安排的時間限制內仍能與講者有充分的問答與討論。本次發表之論文摘要為指導研究生完成之研究海報發表，內容詳見附件。

二、與會心得

本次會議集合了國際各地運動科學領域的學者，集結了以分子生物、生物力學、生理生化學、心理、教育、運動測試與運動醫學領域的運動相關研究，不僅對於運動科學領域的知識有所收穫，也對於不同領域的研究方式與實驗設計有更深入的了解。

ELDERLY INDIVIDUALS
Araujo, C. et al [Brazil]

EP-UD01-70
ASSOCIATION BETWEEN MAXIMAL OXYGEN UPTAKE IMPROVEMENT AND BODY COMPOSITION CHANGES AFTER A WEIGHT LOSS PROGRAM
Castro, E.A. et al [Spain]

EP-UD01-71
ACQUISITION OF PHYSICAL FITNESS AND MOTOR SKILLS PROMOTES PHYSICAL ACTIVITY IN ELEMENTARY SCHOOL CHILDREN: A ONE-YEAR FOLLOW-UP STUDY
Hikihara, Y. et al [Japan]

EP-UD01-72
RISK OF FALLS IN ELDERLY IN THE ASPECT OF PHYSICAL ACTIVITY
Ignasiak, Z. et al [Poland]

EP-UD01-73
SEX DIFFERENCES IN FITNESS AND MOTOR COORDINATION IN PREPUBERTAL CHILDREN BEFORE AND AFTER CONTROLLING FOR MATURATION
Luz, L.G.O. et al [Brazil]

EP-UD01-74
EFFECTS OF AEROBIC DANCE EXERCISE ON THE LOWER LIMBS ISOMETRIC MUSCLE STRENGTH OF ELDERLY PEOPLE.
Nishizawa, T. [Japan]

EP-UD01-75
VO2MAX PREDICTION AND VALIDITY FROM EXERCISE GAS EXCHANGE IN KOREAN.
Im, J. [Korea, South]

EP-UD01-76
THE DEVELOPMENT OF PREDICTION EQUATION FOR ESTIMATING VO2MAX FROM THE 20M PSRT IN KOREAN MIDDLE-SCHOOL GIRLS
Park, D.H. et al [Korea, South]

EP-UD01-77
SPECIFIC NECK/SHOULDER EXERCISES FOR REDUCING MUSCULOSKELETAL DISORDERS AMONG EMPLOYEES IN DENTISTRY.
Fredslund, G. et al [Denmark]

EP-UD01-78
FAT OXIDATION DURING EXERCISE BEFORE AND AFTER WEIGHT LOSS
Jørgensen, A.L. et al [Denmark]

EP-UD01-79
EFFECT OF INTERACTIVE VIDEO GAMES TRAINING ON HYPERTENSION IN ELDERLY
Widjaja, W. et al [Thailand]

EP-UD01-80
EFFECTS OF INCREASING THE DAILY STEP COUNT ON PHYSICAL INACTIVITY AND MENTAL HEALTH IN YOUNG ADULT FEMALES
Kumahara, H. et al [Japan]

EP-UD01-81
INTENSITY AND VOLUME OF PHYSICAL ACTIVITY ARE ASSOCIATED WITH GOOD SLEEP QUALITY IN OLDER ADULTS
Kitano, N. et al [Japan]

EP-UD01-82
ASSOCIATION BETWEEN CARDIOVASCULAR AND METABOLIC DISEASE RISK MARKERS AND PHYSICAL ACTIVITY STATUS IN ADOLESCENTS
Aljaloud, K. [Saudi Arabia]

EP-UD01-83
HABITUAL PHYSICAL ACTIVITY, AND MOTOR COORDINATION IN CHILDREN
Draganidis, D. et al [Greece]

EP-UD01-84
EFFECTS OF FUNCTIONAL STOCKING WEARING ON REPETITION, TOTAL WORK, AND HEART RATE DURING SQUATS IN COLLEGE MALE STUDENTS
Kim, K.H. et al [Korea, South]

EP-UD01-85
HEART RATE ANALYSIS DURING TYPICAL SEVEN DAYS ALPINE SKIING ACTIVITY IN SEDENTARY MEN
Perić, R. et al [Bosnia and Herzegovina]

EP-UD01-86
EFFECT OF A PUBLIC HEALTH PHYSICAL EXERCISE PROGRAM ON CARDIORESPIRATORY FITNESS AND INFLAMMATORY BIOMARKERS
Papini, C.B. et al [Brazil]

EP-UD01-87
IMPACT OF TRAINING FREQUENCY AND SUPERVISION ON COMPLIANCE WITH STRENGTH TRAINING AND SUBSEQUENT CHANGES IN NECK PAIN AND MUSCLE PERFORMANCE
Dalager, T. et al [Denmark]

History

EP-UD01-1
RESEARCH REGARDING THE OCCURRENCE OF NEW ELEMENTS FOR VAULTING TABLE PERFORMANCE IN WOMEN'S ARTISTIC GYMNASTICS
Nakasone, M. [Japan]

Molecular Biology

EP-UD01-1
EFFECTS OF 6 WEEKS SWIMMING TRAINING ON AMMONIA METABOLISM IN SKELETAL MUSCLE IN MICE.
Takeda, K. et al [Japan]

EP-UD01-2
OXIDATIVE STRESS AND AGING: THE RELATIVE ROLE OF REGULAR EXERCISE
Mota, P. et al [Portugal]

EP-UD01-3
WNT INDUCES SATELLITE CELL ACTIVATION IN ADULT AND AGED MICE AFTER VOLUNTARY WHEEL RUNNING
Fujimaki, S. et al [Japan]

EP-UD01-4
MOLECULAR ADAPTATIONS IN MOUSE SKELETAL MUSCLE FOLLOWING EC-CENTRICALLY VERSUS CONCENTRICALLY BIASED TRAINING
Hody, S. et al [Belgium]

EP-UD01-5
CHRONIC PHYSICAL EXERCISE DECREASES GLUCONEOGENESIS AND FASTING PLASMA GLUCOSE THROUGH MODULATION OF MKP-3 AND FOXO1 PROTEIN IN THE LIVER OF OBESE MICE
Moura, L.P. et al [Brazil]

EP-UD01-6
TRANSCRIPTIONAL CHANGES IN BLOOD AFTER AEROBIC TRAINING IN URBAN VERSUS RURAL ENVIRONMENT
Bos, I. et al [Belgium]

EP-UD01-7
VARIATION WITHIN THE MMP3 GENE AS A RISK FACTOR FOR ACHILLES TENDON PATHOLOGY IN A BRITISH POPULATION
El Khoury, L. et al [United Kingdom]

EP-UD01-8
THE EFFECTS OF LACTATE ON SKELETAL MUSCLE ADAPTATION
Willkomm, L. et al [Germany]

Motor Learning

EP-UD01-1
DOES BANDWIDTH-FEEDBACK FACILITATE MOTOR AUTOMATIZATION?
Agehen, M. et al [Germany]

EP-UD01-2
TO INVESTIGATE THE BASIC MOTOR CHARACTERISTIC DIFFERENCES BETWEEN 7 YEARS OLD STUDENTS LIVING IN CITIES AND RURAL AREAS OF KUTAHYA
Gulac, M. et al [Turkey]

EP-UD01-3
AUGMENTED FEEDBACK VERSUS FOCUS OF ATTENTION: EFFECTS ON JUMP PERFORMANCE
Ruffieux, J. et al [Switzerland]

EP-UD01-4
PERFORMANCE IN PRACTICAL <JUMP AND SHUTTLE RUN> TRAINING SETTINGS CAN ONLY BE IMPROVED WITH USE OF AUGMENTED FEEDBACK
Leukel, C. et al [Germany]

EP-UD01-5
EFFECTS OF 18 WEEKS VOLLEYBALL TRAINING TO IMPROVE PHYSICAL FITNESS AND VISUAL TEMPORAL DISCRIMINATION
YU CHUN, C. et al [Taiwan]

EP-UD01-6
REDUCED ERRORS IN OVERHAND THROWING PRACTICE OF CHILDREN:

ANALYSIS OF MOVEMENT COMPONENTS
Capio, C.M. et al [Hong Kong]

EP-UD01-7
EEG BRAIN ACTIVATION PATTERNS IN DIFFERENTIAL AND MENTAL DIFFERENTIAL SOCCER SHOOTING TRAINING
Henz, D. et al [Germany]

EP-UD01-8
DIFFERENTIAL TRAINING AS AN INTERVENTION STRATEGY TO PREVENT CHOKING UNDER PRESSURE IN BASKETBALL FREE-THROW
Lattwein, M. et al [Germany]

EP-UD01-9
INFLUENCE OF PRESSURE ON POSTURAL ADJUSTMENTS IN AN ACCURACY DEMANDING SINGLE-FORWARD-STEPPING TASK
Sasaki, J. et al [Japan]

EP-UD01-10
CORRELATION AMONG BODY CHARACTERISTICS, WHOLE BODY COORDINATION MOTOR TEST AND EMG BASED COHERENCE INDEX OF WALKING IN 6 YEARS OLD CHILDREN
Plevnik, M. et al [Slovenia]

EP-UD01-11
IN EXPERTS, EXPLICIT PROCESSES ARE MORE INVOLVED IN VISUOMOTOR ADAPTATIONS THAN IN NOVICES
Wälchli, M. et al [Switzerland]

EP-UD01-12
EFFECTS OF A SIMULTANEOUS COGNITIVE AND COORDINATION TRAINING ON POSTURAL CONTROL AND DUAL-TASK PERFORMANCE IN OBESE CHILDREN
Kreuser, F. et al [Germany]

Neuromuscular Physiology

EP-UD01-1
CNV RESPONSE TO BADMINTON VIDEO CLIP
Suda, K. et al [Japan]

EP-UD01-2
RELATIONSHIP BETWEEN ACTN3 R577X POLYMORPHISM AND H-REFLEX IN

YOUNG CANOEISTS
Mazur Różycka, J. et al [Poland]

EP-UD01-3
CORTICOSPINAL EXCITABILITY AND INTERLIMB COORDINATION IN KARATE ATHLETES: A MAGNETIC STIMULATION STUDY
Moscatelli, F. et al [Italy]

EP-UD01-4
THE EFFECT OF ORAL ADMINISTRATION OF SODIUM BICARBONATE ON NEUROMUSCULAR ACTIVITY AT A FIXED RPE
Browne, S. [United Kingdom]

EP-UD01-5
DIFFERENT ANKLE MUSCLE COORDINATION PATTERNS DURING QUIET STANCE BETWEEN YOUNG AND OLD ADULTS
Kurz, E. et al [Germany]

EP-UD01-6
PERCEIVED EXERTION AND ELECTROMYOGRAPHY DURING CORE EXERCISES
Cugliari, G. et al [Italy]

EP-UD01-7
MAXIMAL VOLUNTARY CONTRACTION ASSESSMENT: IMPACT OF REAL-TIME VISUAL FEEDBACK OF PERFORMANCE
Simoneau Buessinger, E. et al [France]

EP-UD01-8
TRICEPS SURAE ACTIVATION DURING PLANTAR FLEXION IS AFFECTED BY KNEE EXTENSION
Suzuki, T. et al [Japan]

EP-UD01-9
MOTOR SYSTEM ALTERATION UNDER THE SPINAL CORD STIMULATION
Mikhaylova, E. et al [Russia]

EP-UD01-10
IDENTIFICATION OF GAIT TRANSITION IN HUMANS BASED ON MUSCLE SYNERGIES
Hagio, S. et al [Japan]

EP-UD01-11
MUSCLE FIBER CONDUCTION VELOCITY AND ISOMETRIC RATE OF FORCE DEVELOPMENT
Methenitis, S. et al [Greece]



Effects of 18 weeks volleyball training on physical fitness and visual temporal discrimination

Y. C.CHEN, Y. L.SHIH.*

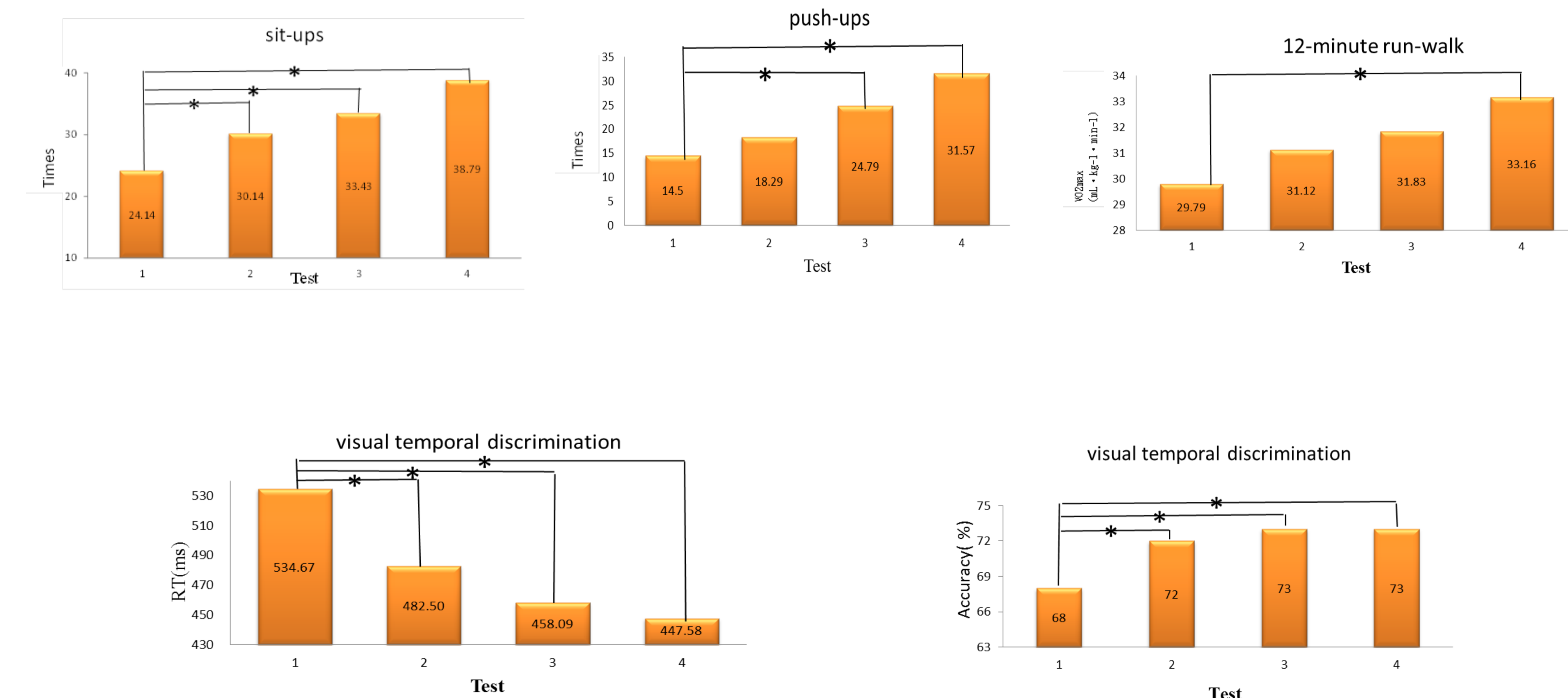
National Taiwan University of Physical Education and Sport, Taichung, Taiwan

Purpose: To maintaining health, people often do exercise to enhance physical fitness. Exercise may have beneficial effects other than physical fitness. For instance, volleyball is an open skill which requires agility for body movement and muscle fitness of the abdominal and arm muscles for ball control. In addition, it also requires aerobic fitness for completing the game. In addition to physical fitness, previous studies showed that professional volleyball players also have better temporal discrimination in visual perception. Therefore, this study aims at exploring whether physical fitness and visual temporal discrimination can be improved by volleyball training.

Method: A total of 14 female university students who do not exercise regularly were recruited in the experiment. They were arranged to receive volleyball training for three months. Visual temporal discrimination and physical fitness, including 12-minute run-walk, push-ups and sit-ups, were tested before training and during training period. These three measures were compared using repeated measure ANOVA in order to investigate the effects of volleyball training.

Results & Discussion: After 18 weeks of volleyball training, the participants showed shorter reaction time and higher accuracy rate in visual temporal discrimination. Previous studies have pointed out that volleyball players must perceive the position of moving ball precisely and quickly in order to execute an appropriate motion. The present findings support that volleyball training is beneficial to improve the performance of visual temporal discrimination. As far as physical fitness was concerned, both measures for muscle endurance and aerobic fitness, i.e. push-ups, sit-ups and 12-minute run-walk, showed significant improvement. Furthermore, the improvement for cardiorespiratory endurance was slower than that for muscle endurance. This may have resulted from that volleyball is an intermittent sport, therefore the challenge for the cardiorespiratory system is not as much as that for the muscular system.

Conclusion: The results of the present experiment suggest that both physical fitness and visual temporal discrimination can be improved by eighteen weeks of volleyball training. While other sports only can improve physical fitness, i.e. running, cycling, the present results suggest that volleyball sport is an alternative choice of physical fitness exercise with cognitive benefits.



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科技部補助計畫衍生研發成果推廣資料表

日期:2016/02/17

科技部補助計畫	計畫名稱：運動訓練經驗對於鏡像神經元系統之調控—探討情緒辨識與運動競賽中預期能力的關聯性
	計畫主持人：石佑翎
	計畫編號：102-2420-H-028-001-MY2 學門領域：心智科學腦影像研究
無研發成果推廣資料	

102年度專題研究計畫研究成果彙整表

計畫主持人：石佑翎		計畫編號：102-2420-H-028-001-MY2				計畫名稱：運動訓練經驗對於鏡像神經元系統之調控—探討情緒辨識與運動競賽中預期能力的關聯性	
成果項目		量化			單位	備註（質化說明： 如數個計畫共同成果、成果列為該期刊之封面故事...等）	
		實際已達成數（被接受或已發表）	預期總達成數（含實際已達成數）	本計畫實際貢獻百分比			
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	2	2	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	1	1	100%		
國外	論文著作	期刊論文	0	2	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	2	2	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
其他成果 （無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）		無					

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	0	

科技部補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以100字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表 未發表之文稿 撰寫中 無

專利： 已獲得 申請中 無

技轉： 已技轉 洽談中 無

其他：（以100字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以500字為限）

The results of the present study suggest that the premotor cortex is crucial for both action and emotion understanding and its participation can be enhanced during taekwondo training. Hence, there could be a mutually beneficial effect between action anticipation and emotion recognition in taekwondo athletes.