科技部補助專題研究計畫成果報告
期末報告

運動介入於婦女經前症狀，認知功能，情緒調節之腦電波研究(第2年)

計 畫 類 別 ： 個別型計畫
計 畫 編 號 ： NSC 101-2629-B-255-001-MY2
執 行 期 間 ： 102年08月01日至103年07月31日
執 行 單 位 ： 長庚學校財團法人長庚科技大學護理系

計 畫 主 持 人 ： 黃人珍
共 同 主 持 人 ： 倪麗芬、石佑翎

報 告 附 件 ： 移地研究心得報告
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，2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
3.「本報告」是否建議提供政府單位施政參考：否

中 華 民 國 103年11月07日

中 文 摘 要 ： 一、中文摘要及關鍵詞 (keywords)
本研究的主要目的在探討運動介入於婦女經前症狀(PMS)、情緒調節腦電波變化之關聯性
。實驗招募31位女性，在進行20分鐘階段性阻力腳踏車耗氧運動前後，以EEG 量測其「悲傷情緒」之腦功能變化。在此份結案報告中主要呈現三個實驗結果。

實驗一：受試者在運動前及運動後大腦於「悲傷情緒抑制 Sad Go/No task」作業中是否有不同反應。主要結果看到：相較中性刺激，Sad NoGo trials 所誘發的腦波訊號(N200)，在運動後其振幅(Amplitude) 於 F2,F4,F8,Fz,C3,C4,Cz 腦區，顯著低於運動前的振幅強度($P < 0.05$)。然而，在行為按鍵之錯誤率 (NoGo behavior error rate)上，運動前後並無不同。此外，我們發現經前症候群積分高之女性於運動後，在F8、F4腦區量測到的N200之潛時 (Latency) 愈短（$P < 0.05$），而此顯著負相關並不存在於運動前(baseline)。結論：「運動」調變了婦女在悲傷情緒抑制作業中，大腦前額葉之活化強度。前額葉在運動後誘發出相較運動前顯著較低的 N200 電位強度在同一件「悲傷情緒抑制」作業中，且行為正確率無異。再則，文獻指出右前額葉(F8，F4)大腦神經元主管「負向情緒」之處理，較高經前症候群積分的女性，於耗氧運動後表現出對悲傷情緒抑制有較快(latency 愈短)的反應速度，此結果反應出長期處於較高經前症候群症候之婦女，大腦的情緒調節調控系統會受到影響，運動介入後有較快反應速度及減弱抑制神經元作功，表徵出健康婦女 brain 在運動過程中情緒調節的可塑性。

實驗二：依經前症後群 (PMS)量表積分高低，分成低與高-PMS組。紀錄婦女在運動前及運動後「悲傷情緒辨識: Sad facial expression recognition」作業中腦活化情形。運用重複測量(Repeat-measurement ANOVA)、T test、Pearson correlation 統計發現：低與高-PMS兩組在N250振幅表現上有顯著不同。高PMS組於運動後-中央前額葉區N250振幅，顯著低於運動前，而此差異並不存在於-低PMS 組。此外，處理悲傷情緒之反應時間(N250 Latency) 與PMS量表中之生理面向(PMS-biology)之關聯性在運動前、後不同，運動前表現出PMS-biology積分愈高，右前額葉(相對於左側)的處理速度愈慢，而此關聯性在運動後消失。顯示，高經前症候群者在處理悲傷之負面情緒時，其大腦神經元對「運動」調控生化代謝反應具更敏感性。

實驗三：人類左右大腦對於認知與情緒有其側化之分工，一般而言左右腦分別特化為負責正負向的情緒。我們量測三十位婦女於耗氧運動前、運動結束後、與運動完休息 90 分鐘後，共三次閉眼休息狀態下之腦波頻譜變化：δ（ 0.5-4Hz)、θ（4－8 Hz)、α（8-13Hz)、β（13-30Hz)、γ（31-40Hz) frequency，結果顯示：右前額葉 θ power 於第一、三次量測有顯著差異。PMS biology 及 emotion 向度上愈負向(即:嚴重)者，會反應在 ”立刻運動完”（第二次量測）後之 δ, α, β 活化強度。而這些各頻譜強度(band power)與 PMS 之交互作用之在運動前(baseline)不存在，且於運動後 90 分鐘回復。

大腦對同樣的「運動介入」因著 PMS 經驗之不同有不同的神經迴路運作。在 PMS 盛行率高達 75%以上之同時，研究建議:積極正視運動介入與善加處理婦女之經前症候群，是刻不容緩的問題。

中文關鍵詞： 經前症候群、運動、神經認知功能、情緒調節、腦波、大腦、悲傷情緒

英文摘要： The studies investigated the impact of aerobic exercise on sad emotion-neural processing weather responsible to different premenstrual experience (PMS) in 31 healthy women by using EEG. All participates were introduced to perform aerobic fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km / hr).

The first experiment: Subjects were completed a sad facial Go/NoGo task. The 1st EEG was recorded before aerobic exercise as a baseline； 2nd EEG was documented after 90 -minute break of aerobic exercise. Event-related potential (ERP) component N200 (N2) over the central frontal region was analyzed because it was often reflects executive cognitive control functions. Findings demonstrated that significant decrease N2 activation at central-prefrontal cortex after exercise to Sad NoGo trials, while the behavior of error rate has no difference

between two measurements. Furthermore, women who had higher PMS scores exhibited faster speed to sad emotion inhibition after aerobic exercise ($P < 0.05$) but it did not reveal before exercise. Alteration of this relationship between PMS scores and N2 latencies and reduced engagement inhibitory neuron activation across fitness, indicated that「exercise」 plays an important role in modulating PMS- related neurocognitive function in sad emotional regulation for women health.
The prevalence of premenstrual syndrome (PMS) was nearly 75-80%. Exercise in?uences on the neurocircuity of emotion regulation and typically increases the flexibility in women with severity PMS. Our results suggest that exercise is a major component of PMS-related variations in emotional cognitive functioning and highlights that adequate management of PMS is crucial for women’s health.

英文關鍵詞： Premenstrual Syndrome (PMS)、Exercise、Neurocognitive function、Emotional regulation、Electroencephalograph(EEG)、Brain、Sad Emotion

行政院國家科學委員會補助專題研究計畫

□ 期中進度報告
■ 期末報告

運動介入於婦女經前症狀,認知功能,情緒調節之腦電波研究

The Effect of Exercise on the Premenstrual syndrome, Neurocognitive function and Emotional regulation: EEG Studies

計畫類別：■個別型計畫　□整合型計畫
計畫編號：NSC 101-2629-B-255 -001 -MY2

執行期間：101 年 8 月 1 日至 103 年 7 月 30 日
執行機構及系所：長庚科技大學

計畫主持人：黃人珍
共同主持人：石佑翎、倪麗芬
計畫參與人員：陳歆如、郭政賢、林恩次、李宥璇、王姿雯、林杏茹、林杰儀、吳秀曄、陳威佑、林芬蘭、顏裕家

本計畫除繳交成果報告外，另含下列出國報告，共 1 份：
□移地研究心得報告
■出席國際學術會議心得報告
□國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢
□涉及專利或其他智慧財產權，□一年　■二年後可公開查詢

中　華　民　國　103 年　10　月　31 日

目　　　　　錄

一、中文摘要及關鍵詞 (keywords)

本研究的主要目的在探討運動介入於婦女經前症狀(PMS)、情緒調節腦電波變化之關聯性。實驗招募 31 位女性，在進行 20 分鐘階段性阻力腳踏車耗氧運動前後，以 EEG 量測其「悲傷情緒」之腦功能變化。在此份結案報告中主要呈現三個實驗結果。

實驗一：受試者在運動前及運動後大腦於「悲傷情緒抑制 Sad Go/No task」作業中是否有不同反應。主要結果看到：相較中性刺激，Sad NoGo trials 所誘發的腦波訊號 (N200)，在運動後其振幅(Amplitude) 於 F2,F4,F8,Fz,C3,C4,Cz 腦區，顯著低於運動前的振幅強度($P < 0.05$)。然而，在行為按鍵之錯誤率 (NoGo behavior error rate)上，運動前後並無不同。此外，我們發現經前症候群積分高之女性於運動後，在 F8、F4 腦區量測到的 N200 之潛時 (Latency) 愈短（$P < 0.05$），而此顯著負相關並不存在於運動前(baseline)。結論：「運動」調變了婦女在悲傷情緒抑制作業中，大腦前額葉之活化強度。前額葉在運動後誘發出相較運動前顯著較低的 N200 電位強度在同一件「悲傷情緒抑制」作業中，且行為正確率無異。再則，文獻指出右前額葉(F8，F4)大腦神經元主管「負向情緒」之處理，較高經前症候群積分的女性，於耗氧運動後表現出對悲傷情緒抑制有較快(latency 愈短)的反應速度，此結果反應出長期處於較高經前症候群症候之婦女，大腦的情緒調節調控系統會受到影響，運動介入後有較快反應速度及減弱抑制神經元作功，表徵出健康婦女 brain 在運動過程中情緒調節的可塑性。

實驗二：依經前症後群 (PMS)量表積分高低，分成低與高-PMS 組。紀錄婦女在運動前及運動後「悲傷情緒辨識: Sad facial expression recognition」作業中腦活化情形。運用重複測量(Repeat-measurement ANOVA)、T test、Pearson correlation 統計發現：低與高-PMS 兩組在 N250 振幅表現上有顯著不同。高 PMS 組於運動後-中央前額葉區 N250 振幅，顯著低於運動前，而此差異並不存在於-低 PMS 組。此外，處理悲傷情緒之反應時間(N250 Latency) 與 PMS 量表中之生理面向(PMS-biology) 之關聯性在運動前、後不同，運動前表現出 PMS-biology 積分愈高，右前額葉(相對於左側)的處理速度愈慢，而此關聯性在運動後消失。顯示，高經前症候群者在處理悲傷之負面情緒時，其大腦神經元對「運動」調控生化代謝反應具更敏感性。

實驗三：人類左右大腦對於認知與情緒有其側化之分工，一般而言左右腦分別特化為負責正負向的情緒。我們量測三十位婦女於耗氧運動前、運動結束後、與運動完休息 90 分鐘後，共三次閉眼休息狀態下之腦波頻譜變化：δ (0.5-4Hz)、θ (4–8 Hz)、α (8-13Hz)、β (13-30Hz)、γ (31-40Hz) frequency，結果顯示：右前額葉 θ power 於第一、三次量測有顯著差異。PMS biology 及 emotion 向度上愈負向(即:嚴重)者，會反應在 ”立刻運動完” (第二次量測) 後之 δ, α, β 活化強度。而這些各頻譜強度(band power)與 PMS 之交互作用之在運動前(baseline)不存在，且於運動後 90 分鐘回復。

大腦對同樣的「運動介入」因著 PMS 經驗之不同有不同的神經迴路運作。在 PMS 盛行率高達 75%以上之同時，研究建議:積極正視運動介入與善加處理婦女之經前症候群，是刻不容緩的問題。

關鍵詞：經前症候群、運動、神經認知功能、情緒調節、腦波、大腦、悲傷情緒

二、英文摘要及關鍵詞 (keywords)

The studies investigated the impact of aerobic exercise on sad emotion-neural processing weather responsible to different premenstrual experience (PMS) in 31 healthy women by using EEG. All participates were introduced to perform aerobic fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km / hr).

The first experiment: Subjects were completed a sad facial Go/NoGo task. The 1st EEG was recorded before aerobic exercise as a baseline; 2nd EEG was documented after 90 -minute break of aerobic exercise. Event-related potential (ERP) component N200 (N2) over the central frontal region was analyzed because it was often reflects executive cognitive control functions. Findings demonstrated that significant decrease N2 activation at central- prefrontal cortex after exercise to Sad NoGo trials, while the behavior of error rate has no difference between two measurements. Furthermore, women who had higher PMS scores exhibited faster speed to sad emotion inhibition after aerobic exercise ($P < 0.05$) but it did not reveal before exercise. Alteration of this relationship between PMS scores and N2 latencies and reduced engagement inhibitory neuron activation across fitness, indicated that「exercise」 plays an important role in modulating PMS- related neurocognitive function in sad emotional regulation for women health.

The second experiment: Facial expression recognition task were conducted to examine the variation of central-frontal cognitive responses for sad emotion stimulus by EEG across 20 minutes aerobic exercise. Based on the PMS scores, the thirty participants were categorized into high- and low- PMS groups. The N250 event-related potential components over the anterior frontal region were analyzed, since N250 particularly sensitive to facial expression. We found that the high PMS group markedly had lower N250 amplitude after exercise than baseline, and this difference did not exist in low-PMS group. Also, a significantly negative correlation was found between biological PMS scores and N250 latency of the relative right side PFC during the first measurement; however, this association became absent after exercise. Our results suggest that brain is vulnerable to degree of PMS. Exercise is a major component of PMS- related variations in emotional cognitive functioning and highlights adequate management PMS is crucial for women's health.

The third experiment: Baseline prefrontal cortex (PFC) activation was a good predictor of emotional regulation processes. 31 subjects underwent resting while their eyes were closed, EEG was recorded for three times. The first measurement (1st) was performed before aerobic exercise while the 2nd recording performed on end of aerobics exercise immediately. The 3rd measured at absolute rest 90 min after the end of activity. The following frequency bands are distinguished: delta (0.5-4Hz), theta (4–8 Hz), alpha (8-13Hz), beta (13-30Hz) and gamma (31-40Hz). Results showed the relationships of PMS- emotion scores and band power (delta, theta, alpha and beta) change across exercise. Further, increasing resting delta, alpha power of relative right-sided baseline frontal activation was correlated to PMS-biology scores after exercise (2nd measurement). These influences of exercise would absent or decade before exercise (1st) or after 90 minutes (3nd). Our findings claimed that the exercise as an energetically modulator in brain emotional regulatory system and response changeable in different premenstrual experience.

The prevalence of premenstrual syndrome (PMS) was nearly 75-80%. Exercise influences on the neurocircuity of emotion regulation and typically increases the flexibility in women with severity PMS. Our results suggest that exercise is a major component of PMS-related variations in emotional cognitive functioning and highlights that adequate management of PMS is crucial for women's health.

Keywords: Premenstrual Syndrome (PMS)、Exercise、Neurocognitive function、Emotional regulation、Electroencephalograph (EEG)、Brain、Sad Emotion

三、前言與研究目的

經前症候群（PMS）是一種與女性月經週期有關的身體、心理及情緒綜合症狀。多數育齡婦女（約 80%）都有一些經前症候群的症狀，其相較於生理腫脹之類的 PMS 徵狀，精神、情緒困擾(如:depression; anxiety)、不穩之症狀對婦女本身生活上的影響更具致殘性 [1]。運動(Physical activity; PA) 對心肺循環、體適能、情緒均有正向作用[2]。在不同好氧強度(aerobic intensity)的運動歷程中，會改變多種的 neurotransmitter 與中樞大腦皮質活化；然而運用腦電波(EEG)探討運動改善 PMS 效能或對情緒調節之神經機制研究證據並不多。

四、文獻探討

運動 (physical activity) 對心肺循環、體適能、情緒均有正向作用[2]。在 81 份 review article 中 85%支持 PRA 可促進 Mental Health 與情緒 (Emotion) [3]，認為多種的 neurotransmitter 在不同好氧強度(aerobic intensity)的運動歷程中，會改變中樞大腦皮質活化 (Central neural activity; CAN)。生理活動可以增加腦血流，透過改變大腦生化物質 neurothrophins，如 nerve growth factor (NGF)、the Brain Derived Neurothrophic Factor (BDNF)、the neurothrophins 3, 4/5,6 (NT 3, NT 4/5、NT6– Neurothrophic Factor) 等，改變大腦認知功能。經前症候群(PMS) 引發行為變化目前認為與黃體期、性激素相關之神經遞質-大腦中的血清素（Serotonin 一種神經遞質）活動的交互作用有關[4] [5]；是指在月經前一週左右出現易怒、焦慮、憂鬱、體重增加、愛吃東西、下腹及胸部腫脹等情況 。近年神經造影工具以檢視出長期 PMS 或經痛婦女其腦部功能與結構上會出現明顯變化，特別在情緒調控區域 [6, 7] [8] [9]。

五、研究目的

本研究主要目的：在以 EEG 量測，探討運動介入於婦女經前症狀, 認知功能, 情緒調節之腦波變化。

六、實驗一：Premenstrual syndrome and the impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study

■ **實驗背景**

Prevalence of PMS which was reported by at least 75% of menstruating women, is associated with various aspects of life, including family interaction, social activities and school performance. Extensive research on humans suggests that aerobic exercise is associated with improving neurocognitive performance, overall physical and psychological health. The present study investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing and possible PMS mediation in 30 healthy women by using 10-20 system EEG. A facial sad Go/NoGo study was conducted to explore the variation of frontal inhibition responses during aerobic fitness training. The anterior frontal N200 (N2) has been found to reflect executive cognitive control functions which are a negative-going wave that peaks around 200-350ms at post-stimulus.

■ **研究方法**

Subjects : Thirty paid volunteers (30 female), righted-handed, around 18–22 years old (mean 24.4 years) participated in the experiment. They were recruited via advertisements which posted around the university. Procedure and Recording: Each subject underwent EEG recording two times. All participates completed the informed consent process and were introduced to perform aerobic Fitness- treadmill 20 minutes by consistent speed around 25.6-28.8mph (16-18km/ hr). Each participant was asked to complete a PMS self-reported before EEG measurement. The first measurement was performed before aerobic exercise (baseline) and the second performed on 90 minutes after fitness training (post test).

Task and Stimuli : Subjects were required to complete a sad facial Go/NoGo task which either responded to a particular emotional facial expression (neutral, fear, and happy; Go trials) or prohibit the response to sadness expression (NoGo trials). An emotionally neutral Go/NoGo task also performed in a different experimental sitting (Figure 1).

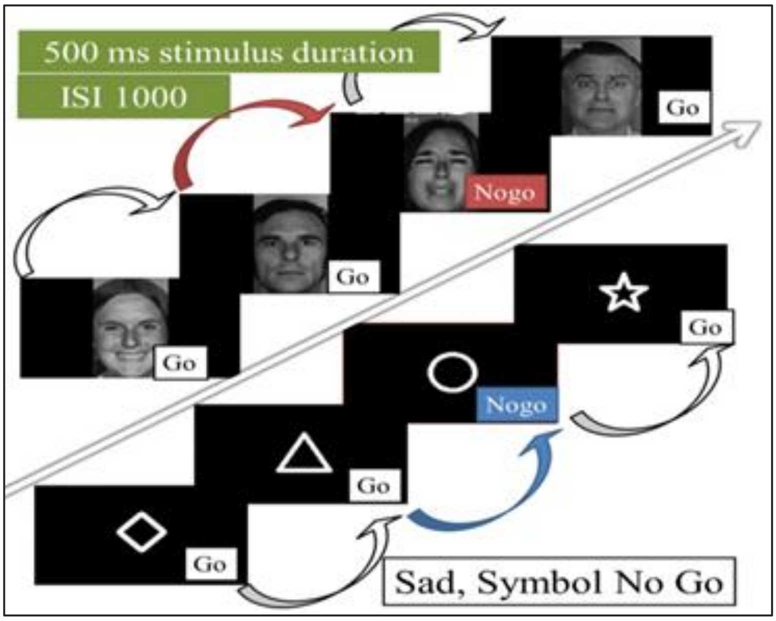


Fig.1 Paradigms of the Sad emotion versus Neutral emotion Go/NoGo task

PMS Inventory: The PMS three-Dimensional Symptom Questionnaire included physical, psychological and behavior self-report. Each of the 14 PMS items was given a weighted score of 1-5, with the rating of 5 indicated the highest level of PMS. Total score range was from 14 to 60.

<u>Analysis:</u> For performance analyses, repeated measurements ANOVAs were calculated (SPSS, Ver. 19) for N2 latency and amplitude at 19 channels and specific recognized analysis for 10 central frontal channels during baseline and second measurements. Where the analysis of variance yielded significant main effects, successive single comparisons using t-tests were calculated.

■ 結果

<u>1. VERP –Sad NoGo N200:</u> A significant different of the mean value of N2 amplitude emerged at F4, Fz, C3, C4, Cz channels (F value = 18.99, 19.55, 8.95, 8.18, 21.05, respectively) during the Sad emotion ($P < 0.01$) NoGgo task, however it did not show in the Neutral condition ($P > 0.05$). A successive comparison with paired t-tests revealed that the mean of N2 amplitude was significantly reducing after aerobic exercise in the sad condition ($P < 0.05$) (Fig 2, Tab 1).

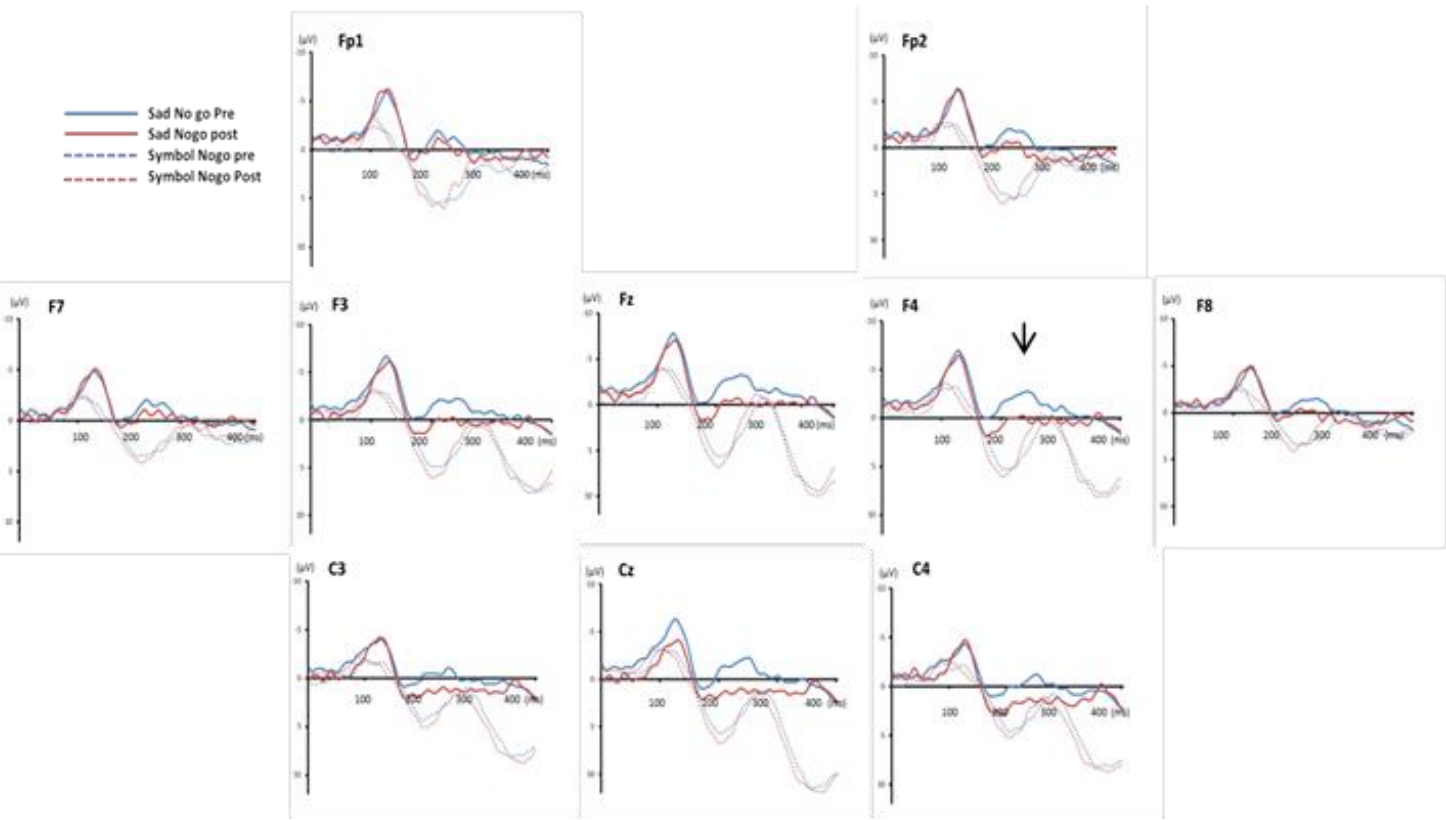


Fig. 2 N2 amplitude of Sad NoGo trials found in 2nd experiment was significant lower than the 1st experiment at F4, Fz, C3, C4, Cz channels ($P < 0.05$). Pre: before exercise; post: after exercise.

Tab. 1 Pair-t-test for aerobic exercise on ERP Amplitude for sad NoGo ; n=30

		Before Mean ± SE	after Mean ± SE	t(29)	P
Fz	sad	-7.704 ± 0.935	-5.008 ± 0.605	-3.09	0.004**
	symbol	-3.229 ± 0.594	-3.975 ± 0.657	1.313	0.199
F4	sad	-6.942 ± 0.940	-4.488 ± 0.637	-2.894	0.007**
	symbol	-2.900 ± 0.522	-3.092 ± 0.552	0.366	0.717
C3	sad	-4.446 ± 0.676	-2.963 ± 0.445	-2.129	0.042*
	symbol	-2.163 ± 0.414	-2.021 ± 0.429	-0.396	0.695
Cz	sad	-6.321 ± 0.888	-3.921 ± 0.495	-2.77	0.01**
	symbol	-2.483 ± 0.516	-1.979 ± 0.580	-1.017	0.318
C4	sad	-4.796 ± 0.815	-2.850 ± 0.441	-2.586	0.015*
	symbol	-2.404 ± 0.406	-1.846 ± 0.429	-1.297	0.205

*p＜.05 ** p＜.01 *** p＜.001

2. Behavioral data

The average of Mean ± SD of PMS total scores, three dimensional- physical, emotion and behavior was 32.9 ± 8.64, 11.87 ± 2.98, 11.97 ± 3.84 and 9.07 ± 3.36, respectively **(Table 2).** The behavioral error rate of the sad and neutral NoGo trials had no change between two experiments **(Table 3).** Mean value (±SD) of the heart rate was the 81.03 ± 13.00, 140.20 ± 18.27 and 84.20 ± 8.31 at before exercise, during exercise and after 90 minutes after exercise, separately. Additional, significant negative correlation between PMS scores and N2 latency at Fz scalp channel was found after exercising (post-test) ($P < 0.05$), while the associations absent at Fz in baseline (1^{st}) (Fig 3)

Tab. 2 Mean and standard deviation of total PMS and three categories biology, emotion and behavior.

	Mean ± SD
PMS total	32.9 ± 8.64
PMS biology	11.87 ± 2.98
PMS emotion	11.97 ± 3.84
PMS behavior	9.07 ± 3.36

Tab. 3 Pair-t-test for aerobic exercise on the Error rate in sad and symbol NoGo condition in 30 participants

Emotion	Exercise	Error rate %	Mean	T (29)	Sig.
Sad condition	Pre	35.42	7.93	1.465	0.154
	Post	24.48	6.83		
Neutral condition	Pre	16.15	3.33	-1.03	0.312
	Post	19.79	3.73		

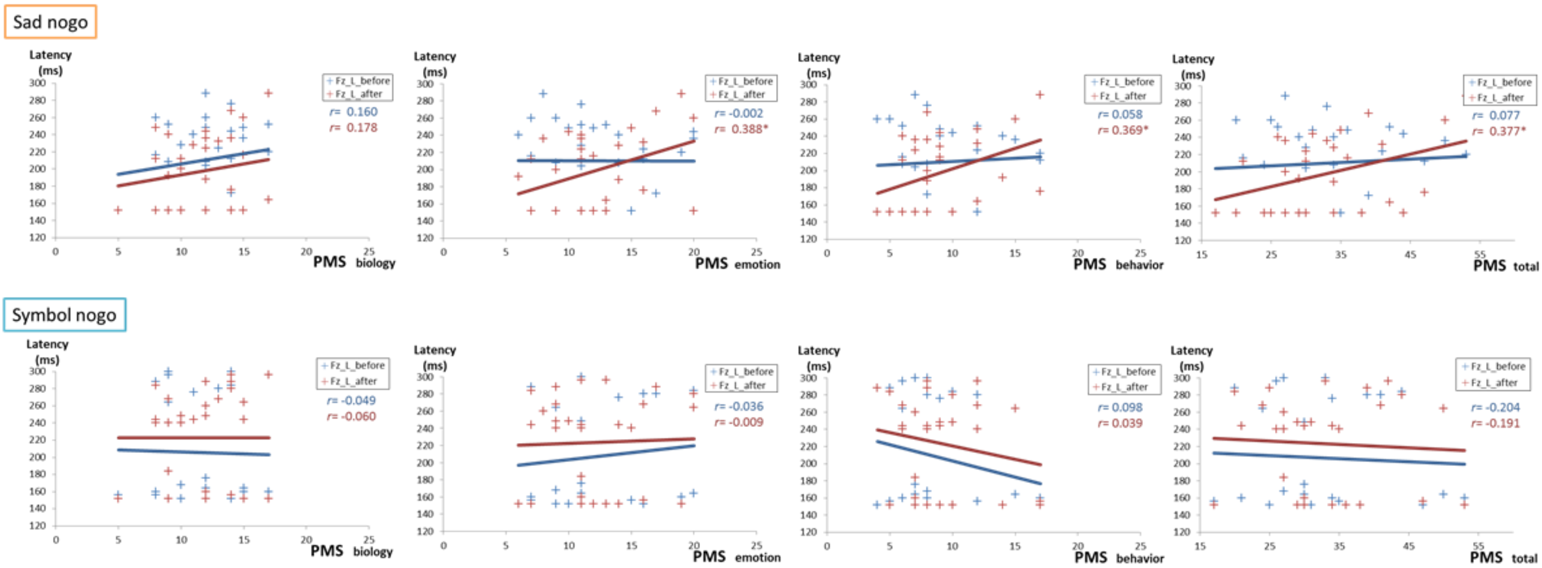


Fig. 3 Significant negative correlation between PMS scores and N2 latency at F8 scalp channel was found in the after exercising (2nd) (P <0.05), while the associations absent at Fz, F8 in baseline (1st); L: N2 latency.

■討論

Findings demonstrated that significant decrease N2 activation at central- prefrontal cortex after exercise to Sad NoGo trials, while the behavior of error rates no difference between two measurements. Reduced engagement of central-prefrontal cortex activation in identical cognitive task performance across exercise, scope a positive effect of exercise, on sadness emotional regulation. Additional, women who had higher PMS scores exhibited faster speed to sad emotion inhibition after aerobic fitness training ($P < 0.05$), however it did not reveal before exercise (Fig. 3). Alteration of this relationship between PMS scores and N2 latency across fitness indicated that exercise play an important role in modulating PMS-related neurocognitive function in emotional regulation for women health.

七、實驗 2. Effects of aerobic exercise on recognition of sad facial expression in women with premenstrual syndrome: An electroencephalography study

■實驗背景

Premenstrual syndrome (PMS) is used to describe physical, cognitive, affective, and behavioral symptoms that occur cyclically during the luteal phase of the menstrual cycle, which resolve quickly at or within a few days of the onset of menstruation. It is quite prevalent among women of reproductive age, up to 75 percent of women experience some degree of premenstrual syndrome (PMS) during their reproductive years [10] [11]. Depression is one of noticeable psychological symptoms related to PMS associated unrelenting sadness accompanied. It has been proposed that exercise is a potential treatment for PMS associated symptomatology, supported by several observational studies [12]. Research combines functional of brain activity and behavioral measures relatively deficiency for women's PMS evaluating. The present study exam the influence of exercise on neural activation of sad emotional cognitive processing associated with premenstrual syndromes by using EEG.

To probe the impact of aerobic exercise on sad emotion-neural processing weather responsible with women different premenstrual experience. Facial expression recognition task were conducted to examine the variation of central-frontal cognitive responses for young women. Previous research has identified several ERPs that are reliably elicited by facial stimuli; the N170 and the N250.The N170 ERP is a negative deflection that peaks approximately 170 ms after stimulus presentation and is thought to reflect detailed processing of facial structure. The N250 ERP is a negative deflection that peaks approximately 250 ms after stimulus presentation and may reflect complex, detailed processing of facial stimuli, including that of facial emotions. The frontal-central distributed N250 has been proposed to index early perceptual recognition processes and decoding of emotional cues (such as the extraction of emotional cues from faces [13]. Streit et al. found a more pronounced N250 component elicited by the faces in the emotion recognition task [13]

■研究方法

Subject: 31 right-handed, healthy, paid volunteers age around 20-25 years old were recruited from the school campus by advertisement. They were asked to restrain from alcohol for 48 hours and caffeine for 12 hours before the day of the experiment. Thirty-one participants were divided into high and low PMS groups according to their total PMS scores.

Procedure: Each subject underwent EEG recording two times. One measurement was performed before aerobic exercise while the other on the absolute rest 90 min after the end of activity. All participates completed the informed consent/assent process and were introduced to perform aerobic Fitness- treadmill 20min.

EEG recording: During the recording process, each volunteer was sitting in front of a screen in a darkroom. The EEG signal was collected by using Medicom MTD Encephalan-EEG.software. Each data was recording from 19 sites: Fp1, Fp2, F3, F4, F7, F8, Fz, C3, C4, Cz, T3, T4, T5, T6, P3, P4, Pz, O1, O2 by using standard 10-20 system with a sampling rate of 250 per second. The high and low filter was 70 and 0.1 Hz and rejecter was 60 Hz.

Task: The Stimuli of Facial expression recognition task was black and white pictures that could clearly distinguish the emotion of facial expression. The pictures were taken from a standard set of pictures of facial affect (Ekman & Friesen, 1976) which presented in the middle of a computer screen on a black background. After the instructor introduced the experiment, 96 monochrome Ekman human facial emotion photo, include 24 of each of happy, neutral, sad and fear emotion (Ekman & Freisen, 1976), were randomly showed on the screen. Each picture would last for 200 ms with 1800 ms Inter-Stimulus Interval (ISI) (Fig.4). The whole recording was around 4 minutes and each volunteer was asked to count the number in mind of sad emotion pictures (Fig.4).

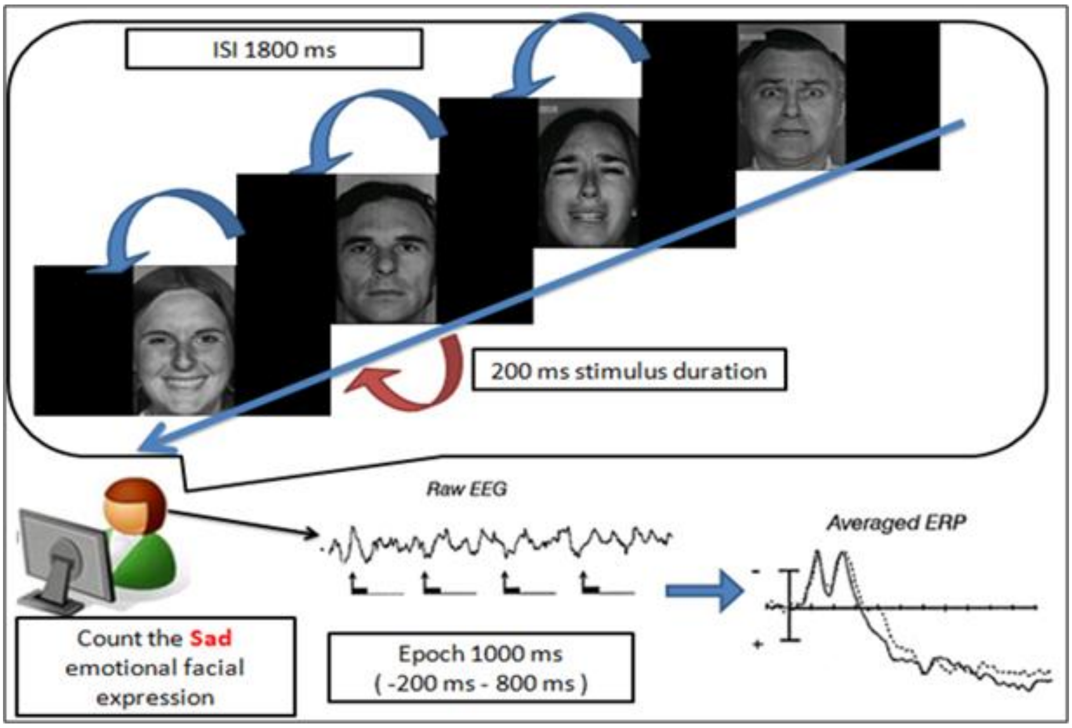


Fig. 4 Sad facial expression recognition task

Fitness training: All participants were introduced to perform aerobic Fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km/hr). A graded practice preceded by a warm-up (5min 1% grade) and each 5 min for 3%, 4% grade, the last 5 min was cool-down phase under grade 2 to1%. We measured heart rate variability three times across fitness training and calculate subject's Maximum Heart Rate by deducting their age from 220.

Self-reported PMS: The Premenstrual syndrome (PMS) self-reported questionnaire had 14 descriptions which were related to biology, emotion or behavior. Subjects needed to read each descripted and score each item from 1(low) to 5(high) according to their self-condition. The higher score indicated the higher level of PMS. Total score was from 14 to 70. Thirty participants were divided into high- and low- PMS separated groups according to their total scores.

Analysis: Subjects were separated to low PMS group (PMS score lower than 30) and high PMS group (PMS score higher than 30) according to their PMS score. A two way analysis of variance (ANOVA) was used across pre-exercise and post-exercise vs. low PMS score and high PMS score. For the study purpose, we specific present 10 central- frontal channels and focus 'Sad facial recognition' discussion and possible PMS facilitator via fitness training. Visual event-related potential (VERP) component of N250 component were analyzed at 10 central-frontal channels (Fp1, Fp2, F3, F4, F7, F8, Fz, C3, C4, Cz) since the activities of these region was specific to emotion regulation. SPSS 19 software was used for statistical analyses. The right and left prefrontal cortex (PFC) were the two regions of interests in current studies, which encompassed N1 powers of FP2+F4+F8 and FP1+F3+F7 channels to RPFC and LPFC, respectively. Mixed effects models for repeated measures were used to evaluate N250 component differences in amplitude and latency to sad facial recognition across physical activity for Low vs. PMS group. When an ANOVA main effect was statistically significant at the $P < 0.05$ level or better, then Bonferroni's post-hoc *t* tests, corrected for multiple comparisons, were run to determine if statistically significant differences existed between specific groups. Paired t test was used to evaluate the differences in VERP within groups in two measurements.

■結果

(1) VERP- N250 component: Repeated ANOVA for aerobic exercise on Low and High PMS score in thirty healthy women in sad facial recognition. A significant different of mean value of N250 amplitude showed at Fp1, Fp2, F7, Fz, F4, F8, C3, Cz, C4 channels($F(1, 31)$= 25.24, 11.09, 15.07, 37.52, 11.98, 8.80, 23.03, 11.53, 15.18, P <0.05), in high PMS group, but it didn't show in low PMS group. A significant difference of mean value of N250 latency showed at Fp2, F7 channels ($F(1, 31)$= 1174.39, 7.22, $P < 0.05$) in low PMS group and F3, F4 ($F(1, 31)$= 4.86, 6.65, P <0.05) in high PMS group (Table 4). A successive comparison with pair-t tests revealed that the mean of N2 amplitude was significantly reducing after exercising at Fp1, Fp2, F7, F3, Fz, F4, F8, C3, Cz, C4 channels in high PMS group (Table 5, Fig5).

Tab.4 Repeated ANOVA for aerobic exercise on Low and High PMS score in thirty healthy women in sad facial recognition in N250

Amplitude		F	P-Value	Latency		F	P-Value
FP1	L PMS	0.273	0.61	FP1	L PMS	0.682	0.424
	H PMS	25.235	.000***		H PMS	1.818	0.201
FP2	L PMS	0.454	0.512	FP2	L PMS	1174.393	.000***
	H PMS	11.086	.005**		H PMS	2.934	0.11
F7	L PMS	0.876	0.366	F7	L PMS	7.216	.019*
	H PMS	15.074	.002**		H PMS	4.419	0.056
F3	L PMS	1.368	0.263	F3	L PMS	0.804	0.386
	H PMS	2.589	0.132		H PMS	4.864	.046*
Fz	L PMS	1.074	0.319	Fz	L PMS	0.069	0.797
	H PMS	37.515	.000***		H PMS	3.1	0.102
F4	L PMS	0.645	0.436	F4	L PMS	0.067	0.8
	H PMS	11.976	.004**		H PMS	4.263	0.059
F8	L PMS	1.144	0.304	F8	L PMS	0.053	0.822
	H PMS	8.795	.011*		H PMS	0.887	0.363
C3	L PMS	0.314	0.585	C3	L PMS	0.944	0.349
	H PMS	23.032	.000***		H PMS	2.105	0.171
Cz	L PMS	1.602	0.228	Cz	L PMS	0.004	0.951
	H PMS	11.525	.005**		H PMS	4.12	0.063
C4	L PMS	0.783	0.392	C4	L PMS	0.003	0.957
	H PMS	15.182	.002**		H PMS	6.648	.023*
Sum left	L PMS	0.8	0.387	Sum left	L PMS	2.392	0.146
	H PMS	12.191	.004**		H PMS	5.273	.039*
Sum right	L PMS	0.037	0.85	Sum right	L PMS	0.065	0.802
	H PMS	0.571	0.463		H PMS	1.889	0.193
asy	L PMS	0.273	0.61	asy	L PMS	0.682	0.424
	H PMS	25.235	.000***		H PMS	1.818	0.201

Tab. 5 Mixed models statistics for within-group and between group differences on Amplitude and latency of VERP N250 component across physical activity in Sad recognition processing for two PMS group.

		Low PMS Group Mean Differences						High PMS Group Mean Differences						Between Group Mean Differences(MD)			
		Baseline mean	±SE	Post-Exercise mean	±SE	Mean Difference	t(df=14)	Baseline mean	±SE	Post-Exercise mean	±SE	Mean Difference	t(df=15)	Pre MD	Pre t (df=29)	Post MD	Post t (df=29)
Fp1	Amp	-4.63	0.75	-3.73	0.83	-0.9	-1.23	-5.73	0.77	-2.05	0.85	-3.68	-3.98**	1.1	1.018	-1.68	-1.405
	Latency	238.67	7.65	240.8	8.04	-2.13	-0.35	230	7.81	240.25	9.98	-10.25	-1.41	8.67	0.792	0.55	0.043
Fp2	Amp	-4.53	0.77	-3.52	0.91	-1.01	-1.03	-5.55	0.85	-1.56	0.8	-3.98	-3.78**	1.02	0.888	-1.95	-1.62
	Latency	231.47	7.6	241.33	8.48	-9.87	-1.08	248.5	9.59	238	8.88	10.5	0.89	-17.03	-1.38	3.33	0.271
F7	Amp	-3.71	0.76	-4.2	0.66	0.49	0.61	-3.97	0.52	-1.85	0.53	-2.12	-4.54***	0.26	0.286	-2.35	-2.782*
	Latency	241.33	8.36	250.4	7.54	-9.07	-1.16	221.5	6.25	234.75	9.34	-13.25	-1.47	19.83	1.916	15.65	1.293
F3	Amp	-4.53	0.68	-4.49	0.92	-0.03	-0.06	-4.84	0.49	-2.13	0.6	-2.7	-4.24***	0.31	0.375	-2.36	-2.174
	Latency	246.67	7.85	251.73	6.86	-5.07	-0.65	230.25	8.05	257.25	9.91	-27	-2.51*	16.42	1.457	-5.52	-0.458
Fz	Amp	-5.31	0.65	-4.18	0.99	-1.13	-1.9	-5.06	0.64	-2.09	0.71	-2.97	-3.44**	-0.25	-0.269	-2.09	-1.734
	Latency	236	7.54	247.73	7.56	-11.73	-1.81	238.25	9.03	246.75	9.76	-8.5	-0.89	-2.25	-0.19	0.98	0.079
F4	Amp	-4.53	0.63	-3.71	0.93	-0.83	-1.09	-4.61	0.54	-2.13	0.67	-2.48	-3.02**	0.08	0.092	-1.58	-1.393
	Latency	237.07	7.43	246.13	7.74	-9.07	-1.31	232.25	8.33	252.5	8.95	-20.25	-1.97	4.82	0.429	-6.37	-0.535
F8	Amp	-4.6	0.67	-3.69	0.74	-0.91	-1.15	-4.33	0.51	-1.59	0.63	-2.73	-3.75***	-0.27	-0.326	-2.1	-2.158*
	Latency	235.73	7.73	242.4	7.48	-6.67	-1.1	242	8.93	247	7.9	-5	-0.48	-6.27	-0.527	-4.6	-0.422
C3	Amp	-2.98	0.65	-3.31	0.98	0.33	0.59	-3.59	0.43	-1.24	0.48	-2.34	-4.69***	0.6	0.77	-2.07	-1.898
	Latency	245.6	6.54	244.8	6.25	0.8	0.1	226.75	7.03	249.5	9.58	-22.75	-2.35*	18.85	1.956	-4.7	-0.411
Cz	Amp	-3.63	0.74	-3.06	1.06	-0.57	-0.87	-4.32	0.54	-1.38	0.6	-2.94	-4.96***	0.7	0.765	-1.68	-1.401
	Latency	240.8	6.76	248.53	6.99	-7.73	-1.02	240.25	9.17	255.25	9.62	-15	-1.92	0.55	0.048	-6.72	-0.565
C4	Amp	-3.63	0.84	-3.07	1.01	-0.57	-0.94	-3.39	0.43	-1.38	0.6	-2.01	-3.08**	-0.24	-0.263	-1.68	-1.454
	Latency	234.93	6.92	247.2	7.7	-12.27	-1.62	236	8.09	252.25	8.36	-16.25	-1.9	-1.07	-0.1	-5.05	-0.443
Sum_L	Amp	-12.87	1.92	-12.43	2.32	-0.44	-0.25	-14.54	1.62	-6.04	1.86	-8.5	-4.48***	1.67	0.668	-6.39	-2.158*
	Latency	726.67	21.81	742.93	20.71	-16.27	-0.86	681.75	20.02	732.25	24.02	-50.5	-2.56*	44.92	1.52	10.68	0.335
Sum_R	Amp	-13.66	1.74	-10.92	2.46	-2.74	-1.19	-14.48	1.68	-5.28	1.95	-9.2	-3.80**	0.83	0.342	-5.64	-1.806
	Latency	690.49	28.18	729.87	21.61	-39.38	-1.65	722.75	22.77	737.5	21.97	-14.75	-0.54	-32.26	-0.896	-7.63	-0.247
asy	Amp	-0.79	0.9	1.51	1.07	-2.3	-1.48	0.05	0.8	0.76	1.33	-0.7	-0.55	-0.85	-0.707	0.75	0.435
	Latency	-36.18	17.17	-13.07	11.61	-23.11	-1.82	41	16.56	5.25	15.12	35.75	1.46	-77.18	-3.236**	-18.32	-0.952

*= significant at the level of 0.05 ; **= significant at the level of 0.01 ; ***= significant at the level of 0.001

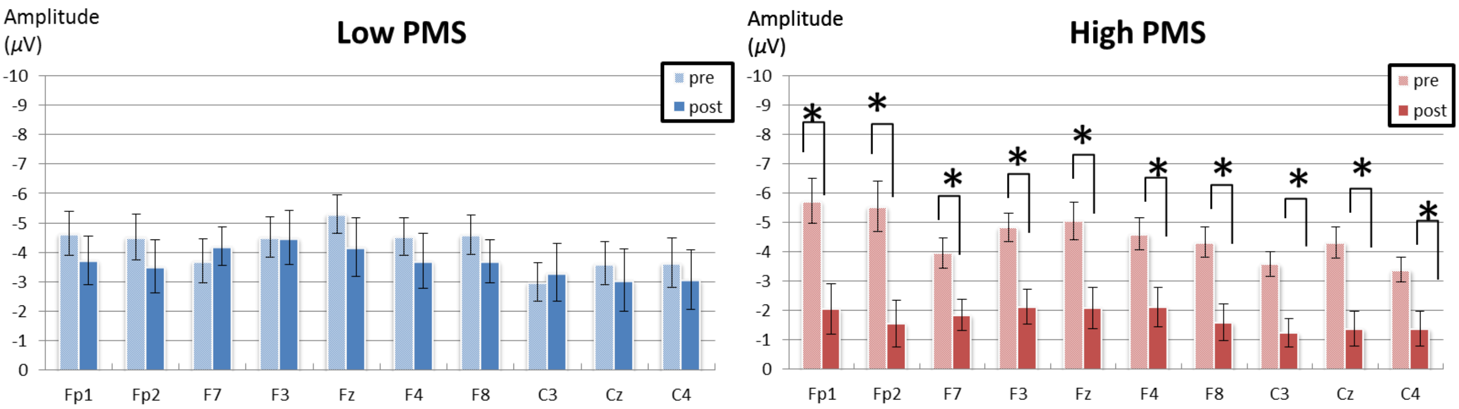


Fig. 5 The Amplitude of N250 at high and low PMS group across physical activity

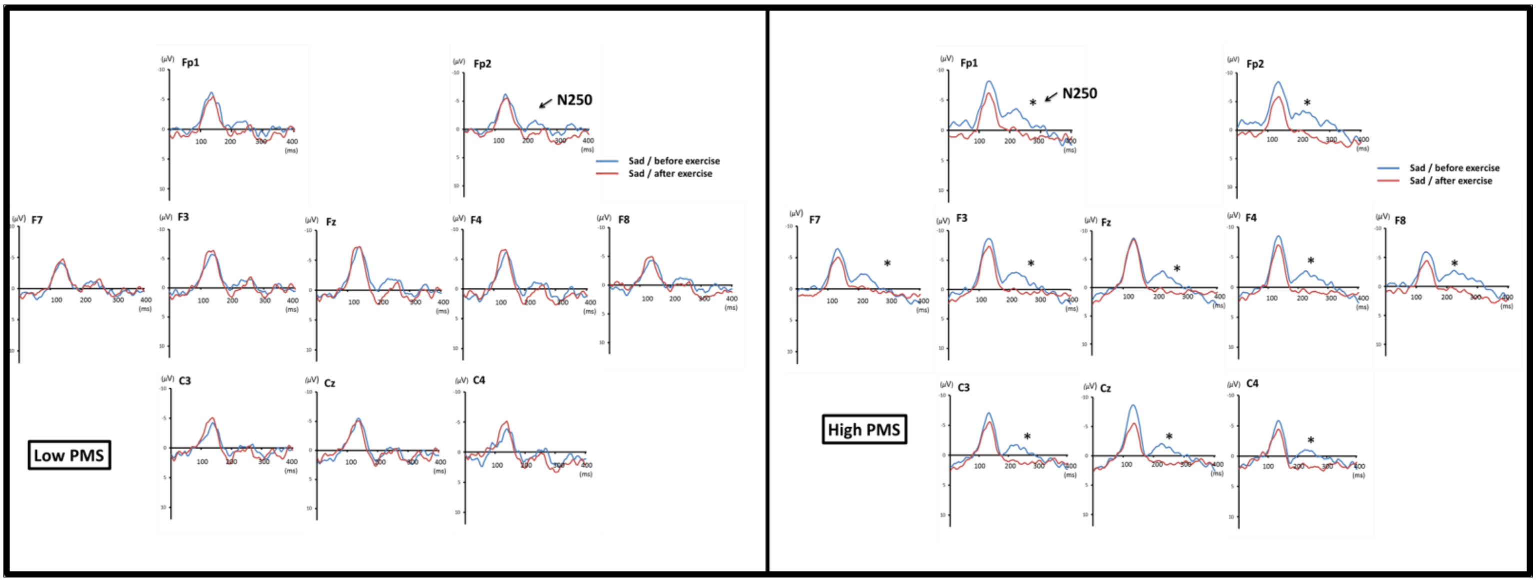


Fig. 6 The N250 component of VERP at high and low PMS group across fitness training

(2) <u>Behavior Assessment-PMS Score:</u> The average of total PMS scores (mean ± SD) in all 31 subjects was 32.61 ± 8.63, and three parts PMS score: PMS biology, PMS emotion, PMS behavior was 11.87 ± 2.93, 11.81 ± 3.88 and 8.94 ± 3.39. While the Mean ± SD of total PMS in high PMS group was 39.06 ± 6.56, and was 25.73 ± 3.95 in low PMS group (Table6)

Tab. 6 The PMS Inventory Result

	total (n=31)	High PMS (n=16)	Low PMS (n=14)
	Mean ± SD	Mean ± SD	Mean ± SD
PMS total	32.61 ± 8.63	39.06 ± 6.56	25.73 ± 3.95
PMS biology	11.87 ± 2.93	13.81 ± 2.26	9.80 ± 2.01
PMS emotion	11.81 ± 3.88	14.56 ± 3.20	8.87 ± 1.81
PMS behavior	8.94 ± 3.39	10.69 ± 3.22	7.07 ± 2.49

(3) <u>Brain-behavior relationship</u>: Significant positive correlation showed between N250 latency and PMS-biology scores ($p < 0.001$) at frontal brain's asymmetry in baseline. However, it didn't present after exercising in other conditions. Frontal brain's asymmetry: sum of N250 latencies for right frontal channels' (Fp1+F3+F7) minus left frontal channels (Fp2+F4+F8) (Figure 7).

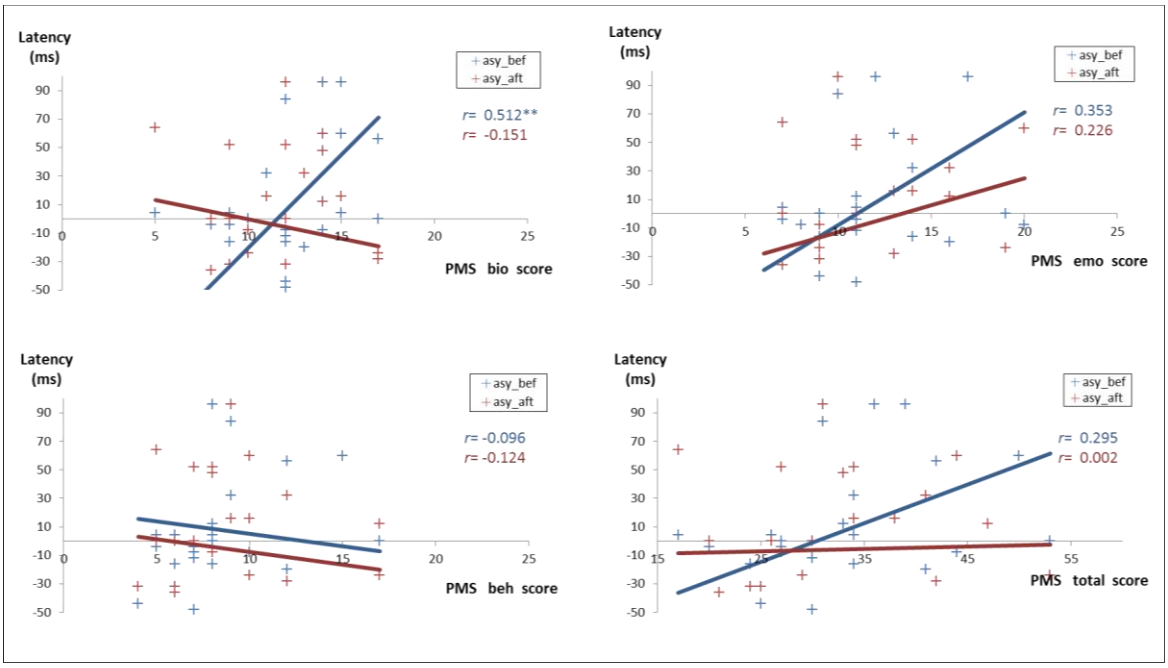


Fig. 7 The correlation between biological PMS scores and N250 latency at the bilateral prefrontal cortex (PFC) varied across exercise for the 31 participants.

■ 討論

The N250 amplitudes in the central frontal regions were significantly attenuated during second measurement (after exercise) than during the first measurement in the high PMS group; however, these amplitudes were similar during both measurements in the low PMS group. The PMS- relevant the neural-cognitive processing dissimilar to sad emotion challenge among 2 groups, indicating that the degree of PMS is mediator interference with exercise schemes alteration, such as neurogenesis promoted, neurotransmitter regulation engagement, boosting mental function or more beneficial resilience by exercise in high PMS group.

Furthermore, the correlation between biological PMS scores and N250 latencies at the bilateral prefrontal cortex (PFC) varied among exercises for the 31 participants. Significantly higher biological PMS scores were associated with slower N250 latencies at the right PFC than at left PFC during the first measurement; however, this association became absent after exercise. The brain is vulnerable to menstrual pain. Because the left versus right PFC region is associated with the approach (positive) and withdraw (negative) -related emotions. Exercise influences affective feedback and typically increases the flexibility in women with degree of PMS. Our results suggest that exercise is a major component of PMS-related variations in emotional cognitive functioning and highlights that adequate management of PMS is crucial for women's health.

八、實驗 3. The correlation between Premenstrual syndrome and Aerobic Fitness: perspectives on frontal EEG asymmetry

■實驗背景

The effect of exercise, “feel better” has been well established, but the specific influence of exercise on affect has not been systematically studied from a PMS or multi-level Psychometric measurement approach. Using of electroencephalographical (EEG) analysis in the science of exercise has been comparatively rare to-date. EEG is a well-established technique, which has been applied in the field of psychology for several decades. Convincing evidence exists indicating that mood changes as well as cognitive and recreational processes are associated with noticeable changes in electrocortical activity [14] [15] [16]. Spontaneous EEG activity is generally divided into the specific frequency ranges delta (0.5–3.5 Hz), theta (3.5–7.5 Hz), alpha (7.5–12.5 Hz), beta (12.5–35 Hz) and gamma (beyond 35 Hz).

One relevant response is the change in frontal brain processes indexed by anterior EEG asymmetry, which is related to approach-withdrawal orientation and affective state. The baseline anterior asymmetry reflects an implicit conceptualization of affective style as a response predisposition that is manifest in frontal EEG asymmetry, with the intention of describing individuals in terms of their general approach or withdrawal tendencies [17]. Recent studies conducted in the laboratory of Davidson suggest that baseline prefrontal cortex (PFC) activation may be a good predictor of emotion regulation processes.

Several literatures converge on the idea that approach and avoidance/withdrawal behaviors are managed by two partially distinct self-regulatory systems. The functions of these systems also appear to be embodied in discrepancy reducing and -enlarging feedback loops, respectively. It is worth noting that no relationship was seen between resting EEG asymmetry and exercise intervention whether mediated with PMS degree.

■研究方法

Subjects: 31 right-handed, healthy, paid volunteers age around 20-25 years old were recruited from the school campus by advertisement. They were asked to restrain from alcohol for 48 hours and caffeine for 12 hours before the day of the experiment.

Procedure: Each subject underwent resting EEG recording three times. All participates were introduced to perform aerobic Fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km/hr). The first measurement (1^{st}) was performed before aerobic exercise while the 2^{nd} recording performed on end of aerobics exercise immediately. The 3^{rd} measured at absolute rest 90 min after the end of activity.

Recording: Participants were tested in a light-controlled and sound-attenuated room. Spontaneous brain activity was recorded continuously for 3 minutes while the subjects relaxed and stayed awake with their eyes closed. EEG signal was recording from 19 sites for the standard 10-20 system which performed in symmetrical brain areas. EEG and EOG were recorded at a sampling rate of 256 Hz/sec and band-pass filtered at 70 –250 Hz.

A computer-based rejection algorithm discarded any epoch with activity greater than ±75μV in amplitude. Fast Fourier Transforms (FFTs) were averaged in five selected frequency bands: Delta (δ; 0.5-4 Hz), Theta (θ; 4–8 Hz), Alpha (α; 8-13 Hz), Beta (β; 13-30 Hz), and Gamma (γ; 31-40 Hz). The RPV (Relative Power Value, %) were analyzed from non-artifact 4 second signal which about 20-45 epochs by power spectrum analysis.

Self-reported PMS : The Premenstrual syndrome (PMS) self-reported questionnaire had 14 descriptions which were related to biology, emotion or behavior. Subjects needed to read each descripted and score each item from 1(low) to 5 (high) according to their total scores..

Analysis: We used SPSS version 19.0 (SPSS Inc, Chicago, Illinois) to perform statistical analyses. Descriptive statistical analyses of group characteristics and neuropsychological assessment (SAI, DI, BIS and IS) conducted. Correlation analyses were performed to evaluate the association between PMS assessment and each frequency band for each electrode site.

■ 結果

Tab. 7 The correlation between 4 PMS scores and band power of 5 brain waves (δ, θ, α, β, γ) at resting eyes closing state; asy: brain asymmetry, Left frontal brain band power (F1+F3+F7) – right frontal brain band power (F2+F4+F8), rest: before exercise, ex1: after exercise, ex2: 30minutes after exercise, PMS: premenstrual syndrome.

		PMS_biology		PMS_emotion		PMS_behavior		PMS_total	
		r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Delta	asy_rest	0.082	0.666	0.107	0.572	0.264	0.159	0.179	0.345
	asy_ex1	-0.394*	0.031	-0.539**	0.002	-0.392*	0.032	-0.528**	0.003
	asy_ex2	-0.224	0.233	-0.204	0.28	0.062	0.745	-0.144	0.449
Theta	asy_rest	-0.067	0.725	-0.055	0.773	-0.108	0.57	-0.09	0.638
	asy_ex1	0.038	0.842	-0.045	0.815	0.128	0.502	0.043	0.822
	asy_ex2	-0.161	0.394	-0.428*	0.018	-0.163	0.39	-0.309	0.096
Alpha	asy_rest	-0.315	0.09	-0.285	0.127	-0.248	0.186	-0.332	0.073
	asy_ex1	0.400*	0.029	0.401*	0.028	0.339	0.067	0.448*	0.013
	asy_ex2	0.092	0.63	0.074	0.698	-0.243	0.196	-0.03	0.875
Beta	asy_rest	0.095	0.616	0.029	0.879	-0.063	0.742	0.021	0.911
	asy_ex1	0.244	0.193	0.492*	0.006	0.319	0.086	0.427*	0.019
	asy_ex2	0.268	0.152	0.316	0.089	0.3	0.107	0.35	0.058
Gamma	asy_rest	0.077	0.685	0.062	0.745	-0.073	0.701	0.026	0.893
	asy_ex1	0.169	0.373	0.343	0.063	0.117	0.537	0.256	0.171
	asy_ex2	0.111	0.559	0.237	0.207	0.054	0.778	0.165	0.384

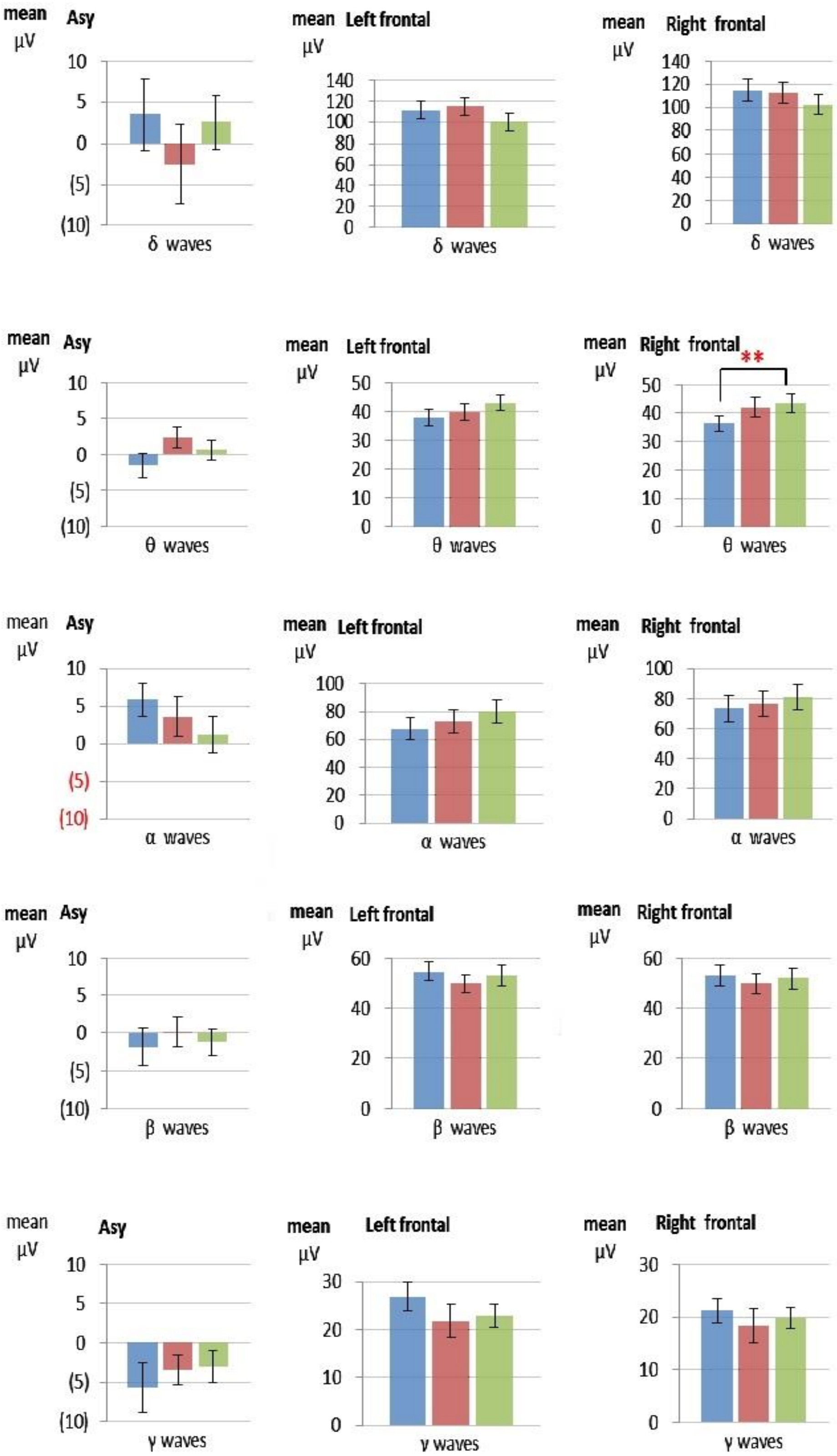


Fig. 7 The frequency power in right and left frontal brain and asymmetry in five different brain waves (δ, θ, α, β, γ); left frontal: F1+F3+F7, right frontal: F2+F4+F8, Asy: Prefrontal asymmetry [Right frontal brain band power (F1+F3+F7) – left frontal brain band power (F2+F4+F8)].

■ 討論

The present study investigated the relationships of PMS features and resting EEG activity with δ (0.5-4Hz)、θ (4–8 Hz)、α (8-13Hz)、β (13-30Hz)、γ (31-40Hz) frequency in young women. The PMS assessment inventory was comprised three dimensions, biology, emotion and behavior. The exercise impact on the relationships of PMS- emotion scores and band power (delta, theta, alpha and beta) of relative right PFC specific showed in after exercise (2^{nd} measurement). The association was not exhibited in the gamma band. Increasing resting delta, alpha power of relative right PFC was correlated to PMS-biology scores also denoted in after exercise (2^{nd} measurement). These influences of exercise would absent or decade before exercise (1^{st}) or after 90 minutes (3^{nd}). Our findings claimed that the exercise as an energetically modulator in brain emotional regulatory system. The relationships changes of PMS and bilateral PFC frequencies activity across physical activity, as well as certain PMS symptoms- specific brain difference, is variability neurogenesis schemes of exercise.

九、國科會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）

Papers in preparation

Effects of aerobic exercise on recognition of sad facial expression in women with premenstrual syndrome: An electroencephalography study

Published Conference poster presentation

Ren-Jen Hwang*, Zhan-Xian Guo, Lee-Fen Ni, Yu-Ling Shih, Yu-Sheun Lee, En-Zi Lin (2013, Dec). The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study . Hong Kong International Conference on Education, Psychology and Society (HKICEPS) ISBN:978-986-87417-3-7 , Hong Kong.

Ren-Jen Hwang, Hsin-Ju Chen , L- F Ni , Yu-Ling Shih（2004）. The Effect of Exercise on the Premenstrual syndrome. Sad Emotional Inhibition: EEG Studies. 國立政治大學：科技部「性別與科技研究計畫」發表討論會.

Unpublished Conference Presentation

Hsin-ju Chen, Jen-Ren Hwang*, Sheun-Yu Lee, Fen-Nee Ni and Chia-Yu Yen (2014, Aug). The different effects of aerobic exercise on recognition of sad facial expression in premenstrual syndrome: an Electroencephalography (EEG) study. 2014 The Asian Network for Public Opinion Research (ANPOR) Niigata, Japan, (Accepted).

Ren-jen Hwang, Ju Hsin Chen, Sheun Yu Lee, Fen Lee Ni and Chia Yu Yen (2014, Aug). Exercise changes the neural bases od Sad emotion regulation associated with premenstrual syndrome in women: an EEG study. 2014 Asian Network for Public Opinion Research Conference Niigata, Japan, November 29-30, 2014 , Niigata, (Accepted)

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）

經前症候群(PMS)與經前不悅症(PMDD)兩者是不同的。PMS 的盛行率達百分之 75-80，而 PMDD 約 3-8%, 乃是介於生育年齡的女性特別受到嚴重經前不適的影響，另外 PMS 與經痛(dysmenorrhea) 也是兩者不同的概念與定義，近五年來國內外以運用腦造影技術，多針對經痛與 PMDD 之大腦型態學或神經元之變化進行探討，本研究計畫在議題上實屬創新。運動帶給有機體之正向影響，不論在身、心、社會層面都已有充分的實驗證據，然運動對「經前症候群」婦女之大腦功能或情緒調節系統上之生理測量，或腦造影實驗上，明顯缺乏。我們在結案報告中的三項研究結果，提供健康照護相關學術或醫療領域，正視與強調運動介入與適當處理經前症候群之重要性。

十、國科會補助專題研究計畫出席國際學術會議心得報告

日期： 103 年 7 月 30 日

計畫編號	NSC 101-2629-B-255 -001 -MY2		
計畫名稱	**運動介入於婦女經前症狀，認知功能，情緒調節之腦電波研究**		
出國人員姓名	黃人珍 林恩次	服務機構及職稱	長庚科技大學
會議時間	102 年 12 月 19 日至 102 年 12 月 20 日	會議地點	香港機場 Regal airport hotel B1 國際會議廳
會議名稱	(中文)香港教育學、心理學暨社會學之國際研討會 (英文) Hong Kong International Conference on Education, Psychology and Society		
發表題目	(中文) 運動介入對悲傷情緒調節之腦波變化 (英文) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study		

■ 參加會議經過與會心得

計劃主持人[黃人珍]

這次本人與研究參與學生林恩次共同赴香港參加一年一度之教育、心理、社會國際研討會(Hong Kong International Conference on Education, Psychology and Society; HKICEPS 2013)，此國際研討會涵蓋了五個主要的學術專業領域的研究報告，(1)HKICEPS (2)Electrical Engineering and Computer Sciences; EECS (3) Symposium on Social Sciences; TISSS (4)Electrical Engineering and Computer Sciences; EECS (5)Engineering and Applied Science; HKICEAS。研習會為期兩天，在聖誕節的前夕 12 月 19 及 20 日，於香港機場 Regal airport hotel B1 國際會議廳舉行，而此次我們所發表的研究結果有兩份，主題分別為 (1) Resting Beta Power Correlates with Impulsivity Strength in Menopausal Women: An Electroencephalography Study (2) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study，在研討會的現場除了海報展示我們的研究成果之外，另外的時間我們是在 B1「巴黎廳」聽 Psychology 及「東京廳」聽 Education、 Psychology 相關研究的發表;以前雖然有不少投稿國外研習會的經驗，但都因公務窒礙難行，這次是我第一次親赴研討會現場經驗到各國不同相關領域研究愛好者對其研究結果的分享，參與心理學與教育場次的研究者有來自美國、澳洲、中國大陸、日本外，也有不少來自印度、菲律賓及我們台灣的學術或教育團體。

從開始計畫參與此次國際研討會之初，在台灣就必須做許多前置作業，這次的兩篇海報發表，就美編及內容上，可見我們是現場上最閃亮的兩張。以神經造影工具探究腦科學的認知功能於國內外已行之有年，我們的研究主題與他人之不同主要是以 EEG 探討「運動介入」於情緒調節之中樞神經機制，我覺得與會者一下子都能透過海報大綱了解我們研究所要表達的核心意義；但對 EEG (N2 是甚麼?, Left vs. Right frontal lobe 之功能，相關之神經科學認知背景知識仍無法一下子了解)，這次大會與會者(報告者)都戰戰兢兢，事前也多做了萬分準備，要在短短的 15min 報告到讓他人能完全了解並不容易；這次跑了幾個廳，感覺到每個場次的 Session Chair 真的很重要，有的可以凝聚來自不同國家參與者，使得一進入那廳場次每個人

好像都認識你一般，有的就做得很分散，到最後因為部分團員太客氣內向就連提問都很少。

語言是參加國際會議必然面臨的，流利表達讓非屬此專業領域的學生(參與者)輕鬆了解並不很容易，並不是很多人一下子就了解我們的 data 節 t/6 有國內研究型大學已近成熟且有不錯的成果，而此認知實驗(如 EEG 與 ERP)應用於醫療照護與健康照護相關領域之實務型研究仍較為缺乏。我們的研究結果主要是要分享與會團體運動的介入：可以調變大腦對負向(悲傷)情緒的抑制能力

研究助理 [林恩汝]

參與 Hong Kong International Conference on Education, Psychology and Society (HKICEPS)研討會，不管是行前或是會議中皆學習到許多。首先行前的海報製作與佈置，學習運用 Microsoft Power Point 編排、美觀，而製作的過程中也對於黃人珍老師的研究內容有更進一步的認知。研討會過程中分為兩部分的研究分享：海報發表、口說發表。這一趟老師與我參加的是海報發表，也就是將海報展覽在會場，研究者們可以在會場中自行觀看不同的海報主題，有問題甚至可以直接與研究者討論，這真的是一個很棒的學術交流！另一個部分是口說發表，每位研究者在有限的時間內(每一位約 15 分鐘)，將自己的研究結果以簡報的方式與大家說明並分享，在報告結束時也會讓聽眾提出問題並討論。

其中印象最深刻的一場口說發表為：Impact of Parental Attitudes on Emotional Intelligence and Adjustment of Adolescents.作者採用隨機抽樣並藉由三份專業設計的量表，經過統整分析所得到的結果。作者詳細說明抽樣背景、研究結果準確度、研究過程的數據……，然而相關術語有些複雜難懂，但藉由這場報告讓我明白一份研究計畫是如何從頭到尾的誕生，也算是收穫。

研討會過程全程使用英文，因此部分內容在當下無法理解，但研討會後附有每一位參與者的研究結果之檔案，因此返國後可以繼續觀看研究結果並額外查詢相關資料，增進多方面的認知。而這樣的過程中，除了更深入老師的研究計劃，也參與到更寬廣的學術層面，是個很棒的經驗！

研討會讓我接觸並瞭解到國際觀，加倍體認到英文的重要性，對於日後學習英文的動力瞬間增加許多，是很棒的額外收穫。

學生認為參與此趟研討會，大大的改變並增進我對護理跨領域的認知！護理不僅僅是在醫院、診所當護理師；在學校當老師；或是在辦公室做研究，侷限在自己的工作崗位上，可以藉由個人或團體的研究結果發表，與世界各地的研究者分享、討論彼此的研究成果，衝擊出更多的想法與交流。每一位研究者的背景不盡相同，在這樣的狀態下，促成了多樣性題材的研究結果，讓我對於護理、社會心理學有了更廣泛的接觸，很開心接觸到這難能可貴的機會，參與了這麼棒的學術研討會，讓身為護理系學生的我在未來規劃，也有了更多不同的想法與出路！非常感謝此次帶我同行的黃人珍老師與其之研究計畫！

每一份行業如果都能找到興趣並付出努力，必能成為該科的專家！

十一、摘要與海報發表 (ABSTRACT and POSTER)

Extensive research on humans suggests that aerobic exercise is associated with improving neurocognitive performance, overall physical and psychological health. The present study investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing in 13 healthy women by using 10-20 system electroencephalography (EEG). Facial emotional Go/NoGo tests were conducted to examine the variation of frontal inhibition responses for Sad NoGo versus Neutral NoGo trials across 20-min aerobic fitness training sessions. The first test was performed before aerobic exercise (baseline; first), and the second experiment was performed during absolute rest 30 minutes after the end of exercise training. The event-related potential (ERP) component N200 (N2) over the anterior frontal region was analyzed because it often reflects executive cognitive control functions. The main results were that sad NoGo trials evoked higher N200 amplitude from the FP2 scalp at the baseline (first) than at the second measurement ($P < 0.05$). Conversely, the behavioral accuracy of the sad NoGo trials was found significantly increase in after exercise (second) ($P < 0.05$). There were no differences in behavioral accuracy rates and N2 amplitudes during neutral conditions throughout the training. Healthy women who exhibited improving behavior inhibition to sadness cues after exercise, however, also presented a reduced engagement of right frontal activation. Exercise has been shown to benefit brain function for several decades. The current EEG study provides the first evidence that aerobic exercises play a critical role in regulating the neural basis of sad emotion inhibition processing in healthy women.

The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study

Ren-Jen Hwang [1,*], Zhan-Xian Guo[1], L- F Ni [1], Yu-Ling Shih[2], Yu-Sheun Lee[1], En-Zi Lin[1]
[1] Chang Gung University of Science and Technology (CGUST) , Tao-Yuan, Taiwan
[2] Department of Sport Performance, National Taiwan University of Physical Education and Sport

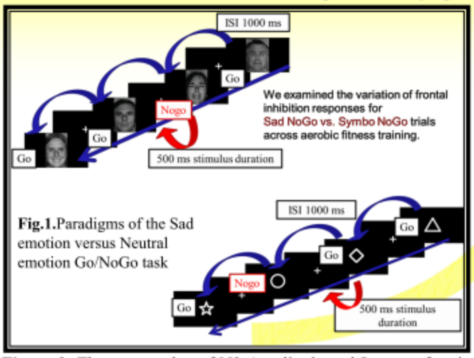
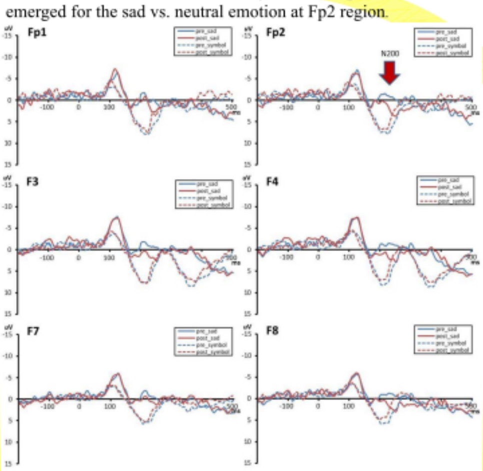


Fig.1.Paradigms of the Sad emotion versus Neutral emotion Go/NoGo task

Figure 2. The mean value of N2 Amplitude and Latency for six frontal channels was found that significant amplitude difference emerged for the sad vs. neutral emotion at Fp2 region.



Introduction

■Exercise has drawing enhanced positive emotion while less evidence into the neural substrates via neuroimaging studies. Keeping pace with the examination of the cognitive influences of acute exercise, we investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing.

■The emotional Go/NoGo task can serve an effective probe for frontal lobe functions . A facial sad Go/NoGo study was conducted to explore the variation of frontal inhibition responses during aerobic fitness training. The anterior frontal N200 (N2) has been found to reflect executive cognitive control functions which is a negative-going wave that peaks around 200-350ms at post-stimulus.

Material and Methods

■***Subjects***: Thirteen paid volunteers (13 female), righted-handed, aged 18–22 years (mean 24.4 years) participated in the experiment. They were recruited via advertisements posted around the university.

■***Procedure and Recording***: Each subject underwent EEG recording two times. All participates completed the informed consent process and were introduced to perform aerobic Fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km/hr). The first measurement (1st) was performed before aerobic exercise (baseline) and the second performed on the 90 min after fitness training (posttest).

■***Task and Stimuli***: Subjects were required to complete a sad facial Go/NoGo task which either sponded to a particular emotional facial expression (neutral, fear, and happy; Go trials) or prohibit the response to sadness expression (NoGo trials). An emotionally neutral Go/NoGo task also performed in a different experimental sitting **(Figure 1)**.

■***Analysis***: For performance analyses, repeated measurements ANOVAs were calculated (SPSS, Ver. 17.0) for N2 latency and amplitude at 19 channel and specific recognized analysis for each frontal channel (Fp1, Fp2, F3, F4, F7, F8) during baseline and 2nd measurements. Where the analyses of variance yielded significant main effects, successive single comparisons using t-tests were calculated.

Results

■A significant difference of the mean value of N2 amplitude emerged for the Sad emotion (F =21.397, $P < 0.01$) during training while did not show in the Neutral emotion (F =1.456, $P > 0.05$) at Fp2 **(Figure 2,Table 1)**. The N2 latency had no differences emerged for the sad NoGo trials (F=3.453, $P > 0.05$) and the Neutral emotion (F =0.15, $P > 0.05$.A successive comparison with paired t-tests revealed that the mean of N2 amplitude was significantly lower in after aerobic exercise for the sad condition (t =-2.396, $P < 0.05$) **(Table 2).** The behavioral accuracy rate of the Sad NoGo trials was found significantly increase in after exercise (2nd) then baseline ($P < 0.05$) **(Table 3).**

Table 1 Repeated ANOVA for aerobic exercise on Sad and Symbol NoGo in thirteen healthy women

Repeated ANOVA Within Effects			
		F	P-Value
Amplitude	Sad-Emotion	21.397	0.001**
	Symbol-Emotion	1.456	0.253
Latency	Sad-Emotion	3.453	0.09
	Symbol-Emotion	0.150	0.71

*p<.05 ** p<.01 *** p<.001

Table 2 Pair-*t*-test for aerobic exercise on ERP N_2 Amplitude for Sad NoGo in thirteen healthy women

Condition	Aerobic Exercise	N	Mean	T	Sig.
Sad	Pre	12	-4.833	-2.396	0.035**
	Post	12	-3.073		

*p<.05 ** p<.01 *** p<.001

Table 3 Pair-*t*-test for aerobic exercise on the accuracy rate in sad and Neutral emotion NoGo trials in thirteen healthy women

Condi -tion	Aerobic Exercise	N	Mean	SD	T	Sig.
Sad	Pre	13	16.846	2.4781	-3.33	.006**
	Post	13	18.385	2.5344		
Symbol	Pre	13	21	2.273	-0.33	0.746
	Post	13	21.154	1.4632		

*p<.05 ** p<.01 *** p<.001

Discussion

The main results were that sad NoGo trials evoked higher N200 amplitude from the Fp2 scalp at the baseline (first) than at the second measurement ($P < 0.05$). Conversely, the behavioral accuracy of the sad NoGo trials was found significantly increase in after exercise (second) ($P < 0.05$). There were no differences in behavioral accuracy rates and N2 amplitudes during neutral conditions throughout the training. Healthy women who exhibited improving behavior inhibition to sadness cues after exercise, however, also presented a reduced engagement of right frontal activation. These findings extend the scope of positive effects of aerobic exercise beyond emotional regulation, and results suggest a strong solid neural basis for the benefits of exercise on the sad emotion inhibition processing in healthy women.

Acknowledgements

We thank the 13 participants as well as administrant supported by CGUST . The funds of this project were supported by the National Science Council (NSC 100-2410-H-255 -005 -MY2；NSC 101-2629-B-255 -001 -MY2) and CGUST (NMRPF3B0132；BMRPC52).

The Effect of Exercise on the Premenstrual syndrome, Sad Emotional Inhibition: EEG Studies

Ren-Jen Hwang [1], Hsin-Ju Chen[1], L- F Ni [1], Yu-Ling Shih[2],
[1] Chang Gung University of Science and Technology (CGUST) , Tao-Yuan, Taiwan
[2] Department of Sport Performance, National Taiwan University of Physical Education and Sport

Introduction

- Prevalence of PMS reported by at least 75% of menstruating women, is associated with various aspects of life, including family interaction, social activities and school performance. Extensive research on humans suggests that aerobic exercise is associated with improving neurocognitive performance, overall physical and psychological health. The present study investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing and possible PMS mediation in 30 healthy women by using 10-20 system electroencephalography (EEG).
- A facial sad Go/NoGo study was conducted to explore the variation of frontal inhibition responses during aerobic fitness training. The anterior frontal N200 (N2) has been found to reflect executive cognitive control functions which is a negative-going wave that peaks around 200-350ms at post-stimulus.

Material and Methods

- ***Subjects***: Thirty paid volunteers (30 female), righted-handed, around 18–22 years old (mean 24.4 years) participated in the experiment. They were recruited via advertisements which posted around the university.
- ***Procedure and Recording***: Each subject underwent EEG recording two times. All participates completed the informed consent process and were introduced to perform aerobic Fitness- treadmill 20mins by consistent speed around 25.6-28.8mph (16-18km/ hr). Each participant was asked to complete a PMS self report before EEG measurement. The first measurement (1st) was performed before aerobic exercise (baseline) and the second performed on 90 mins after fitness training (post test).
- ***Task and Stimuli***: Subjects were required to complete a sad facial Go/NoGo task which either responded to a particular emotional facial expression (neutral, fear, and happy; Go trials) or prohibit the response to sadness expression (NoGo trials). An emotionally neutral Go/NoGo task also performed in a different experimental sitting **(Figure 1).**

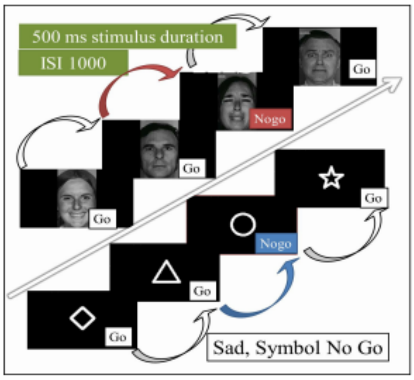


Fig.1.Paradigms of the Sad emotion versus Neutral emotion Go/NoGo task

- ***PMS Inventory***: The PMS three-Dimensional Symptom Questionnaire include physical, psychological and behavior self report. Each of the 14 PMS items was given a weighted score of 1-5, with the rating of 5 indicated the highest level of PMS. Total score range was from 14 to 60.
- ***Analysis***: For performance analyses, repeated measurements ANOVAs were calculated (SPSS, Ver. 21) for N2 latency and amplitude at 19 channels and specific recognized analysis for 10 central frontal channels during baseline and 2nd measurements. Where the analysis of variance yielded significant main effects, successive single comparisons using t-tests were calculated.

Result

- A significant different of the mean value of N2 amplitude emerged at F4,Fz,C3,C4,Cz channels (*F* value= 18.99, 19.55, 8.95, 8.18, 21.05, respectively) during the Sad emotion ($P < 0.01$) nogo task, however it did not show in the Neutral condition ($P > 0.05$). A successive comparison with paired t-tests revealed that the mean of N2 amplitude was significantly reducing after aerobic exercise in the sad condition ($P < 0.05$) **(Fig 2).**

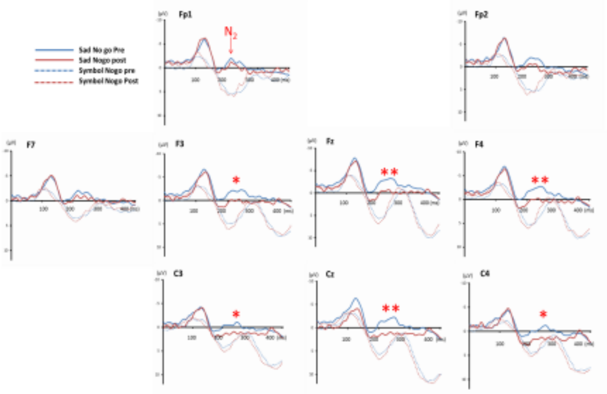
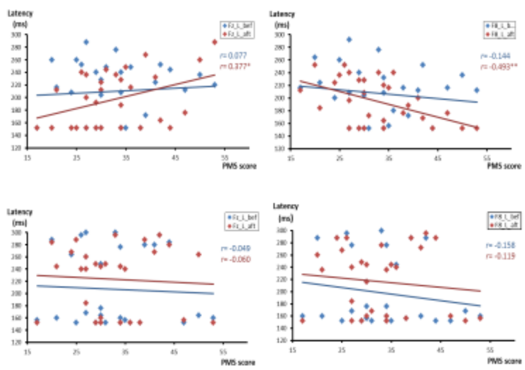


Fig 2. (left)
N2 amplitude of Sad NoGo trials found in 2nd experiment was significant lower than the 1st experiment at F4, Fz, C3, C4, Cz channels(P <0.05). Pre: before exercise; post: after exercise

Fig 3. (below)
Significant negative correlation between PMS scores and N2 latency at F8 scalp channel was found in the after exercising (2nd) (P <0.05), while the associations absent at Fz, F8 in baseline (1st); L: N2 latency.



- The average of PMS scores (mean ± SD) was 32.61 ± 8.64. The behavioral error rate of the sad NoGo trials had no change between two experiments.
- Findings demonstrated a reduced engagement of central-prefrontal cortex activation in identical cognitive task performance, or behavioral presentation after training, as scope a positive effect of exercise on sadness emotional regulation.
- Women who had higher PMS scores exhibited faster speed to sad emotion inhibition after aerobic fitness training ($P < 0.05$), however it did not reveal before exercise (fig 3). Alteration of this relationship between PMS scores and N2 latencies across fitness indicated that exercise play an important role in modulating PMS- related neurocognitive function in emotional regulation for women health.

Acknowledgements: We thank the 30 participants as well as administrant supported by CGUST . The funds of this project were supported by the National Science Council (NSC 100-2410-H-255 -005 -MY2 ; NSC 101-2629-B-255 -001 -MY2) and CGUST (NMRPF3B0132 ; BMRPC52).

[Reference]

1. Bloch M, Schmidt PJ, Rubinow DR: **Premenstrual syndrome: evidence for symptom stability across cycles**. *The American journal of psychiatry* 1997, **154**(12):1741-1746.
2. Penedo FJ, Dahn JR: **Exercise and well-being: a review of mental and physical health benefits associated with physical activity**. *Current opinion in psychiatry* 2005, **18**(2):189-193.
3. Yeung RR: **The acute effects of exercise on mood state**. *J Psychosom Res* 1996, **40**(2):123-141.
4. Pearlstein TB: **Hormones and depression: what are the facts about premenstrual syndrome, menopause, and hormone replacement therapy?** *American journal of obstetrics and gynecology* 1995, **173**(2):646-653.
5. Soares CN, Almeida OP, Joffe H, Cohen LS: **Efficacy of estradiol for the treatment of depressive disorders in perimenopausal women: a double-blind, randomized, placebo-controlled trial**. *Arch Gen Psychiatry* 2001, **58**(6):529-534.
6. Accortt EE, Stewart JL, Coan JA, Manber R, Allen JJ: **Prefrontal brain asymmetry and pre-menstrual dysphoric disorder symptomatology**. *Journal of affective disorders* 2011, **128**(1-2):178-183.
7. Bannbers E, Gingnell M, Engman J, Morell A, Comasco E, Kask K, Garavan H, Wikstrom J, Sundstrom Poromaa I: **The effect of premenstrual dysphoric disorder and menstrual cycle phase on brain activity during response inhibition**. *Journal of affective disorders* 2012, **142**(1-3):347-350.
8. Cubeddu A, Bucci F, Giannini A, Russo M, Daino D, Russo N, Merlini S, Pluchino N, Valentino V, Casarosa E *et al*: **Brain-derived neurotrophic factor plasma variation during the different phases of the menstrual cycle in women with premenstrual syndrome**. *Psychoneuroendocrinology* 2011, **36**(4):523-530.
9. Tu CH, Niddam DM, Chao HT, Chen LF, Chen YS, Wu YT, Yeh TC, Lirng JF, Hsieh JC: **Brain morphological changes associated with cyclic menstrual pain**. *Pain* 2010, **150**(3):462-468.
10. Johnson SR: **The epidemiology and social impact of premenstrual symptoms**. *Clinical obstetrics and gynecology* 1987, **30**(2):367-376.
11. Steiner M: **Premenstrual syndromes**. *Annual review of medicine* 1997, **48**:447-455.
12. Eriksson O, Wall A, Marteinsdottir I, Agren H, Hartvig P, Blomqvist G, Langstrom B, Naessen T: **Mood changes correlate to changes in brain serotonin precursor trapping in women with premenstrual dysphoria**. *Psychiatry research* 2006, **146**(2):107-116.
13. Streit M, Wolwer W, Brinkmeyer J, Ihl R, Gaebel W: **Electrophysiological correlates of emotional and structural face processing in humans**. *Neuroscience letters* 2000, **278**(1-2):13-16.
14. Davidson RJ: **Anterior electrophysiological asymmetries, emotion, and depression: conceptual and methodological conundrums**. *Psychophysiology* 1998, **35**(5):607-614.
15. Dussault C, Jouanin JC, Philippe M, Guezennec CY: **EEG and ECG changes during simulator operation reflect mental workload and vigilance**. *Aviation, space, and environmental medicine* 2005, **76**(4):344-351.
16. Schutter DJ, de Weijer AD, Meuwese JD, Morgan B, van Honk J: **Interrelations between motivational stance, cortical excitability, and the frontal electroencephalogram asymmetry of emotion: a transcranial magnetic stimulation study**. *Human brain mapping* 2008, **29**(5):574-580.
17. Coan JA, Allen JJ, McKnight PE: **A capability model of individual differences in frontal EEG asymmetry**. *Biological psychology* 2006, **72**(2):198-207.

補助 102 年國外差旅費 120000 元: 包含以下

移地研究：80,000 元

出席國際學術會議：40,000 元

於 2013-12/19- 12/20 至香港 出席國際會議 支出 85673 元

餘 34327 元 挪至人事費運用

是否 此移地研究報告 上傳 出席國際學術會議替代

國科會補助專題研究計畫出席國際學術會議心得報告

日期：103 年 7 月 30 日

<table>
<tr><td>計畫編號</td><td colspan="3">NSC 101-2629-B-255 -001 -MY2</td></tr>
<tr><td>計畫名稱</td><td colspan="3">運動介入於婦女經前症狀，認知功能，情緒調節之腦電波研究</td></tr>
<tr><td>出國人員姓名</td><td>黃人珍
林恩次</td><td>服務機構及職稱</td><td>長庚科技大學</td></tr>
<tr><td>會議時間</td><td>102 年 12 月 19 日至
102 年 12 月 20 日</td><td>會議地點</td><td>香港機場 Regal airport hotel B1 國際會議廳</td></tr>
<tr><td>會議名稱</td><td colspan="3">(中文)香港教育學、心理學暨社會學之國際研討會
(英文) Hong Kong International Conference on Education, Psychology and Society</td></tr>
<tr><td>發表題目</td><td colspan="3">(中文) 運動介入對悲傷情緒調節之腦波變化
(英文) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study</td></tr>
</table>

■ 參加會議經過與會心得

計劃主持人[黃人珍]

這次本人與研究參與學生林恩次共同赴香港參加一年一度之教育、心理、社會國際研討會 (Hong Kong International Conference on Education, Psychology and Society; HKICEPS 2013)，此國際研討會涵蓋了五個主要的學術專業領域的研究報告，(1)HKICEPS (2)Electrical Engineering and Computer Sciences; EECS (3) Symposium on Social Sciences; TISSS (4)Electrical Engineering and Computer Sciences; EECS (5)Engineering and Applied Science; HKICEAS。研習會為期兩天，在聖誕節的前夕 12 月 19 及 20 日，於香港機場 Regal airport hotel B1 國際會議廳舉行，而此次我們所發表的研究結果有兩份，主題分別為 (1) Resting Beta Power Correlates with Impulsivity Strength in Menopausal Women: An Electroencephalography Study (2) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study，在研討會的現場除了海報展示我們的研究成果之外，另外的時間我們是在 B1「巴黎廳」聽 Psychology 及「東京廳」聽 Education、 Psychology 相關研究的發表;以前雖然有不少投稿國外研習會的經驗，但都因公務窒礙難行，這次是我第一次親赴研討會現場經驗到各國不同相關領域研究愛好者對其研究結果的分享，參與心理學與教育場次的研究者有來自美國、澳洲、中國大陸、日本外，也有不少來自印度、菲律賓及我們台灣的學術或教育團體。

從開始計畫參與此次國際研討會之初，在台灣就必須做許多前置作業，這次的兩篇海報發表，就美編及內容上，可見我們是現場上最閃亮的兩張。以神經造影工具探究腦科學的認知功能於國內外已行之有年，我們的研究主題與他人之不同主要是以 EEG 探討「運動介入」於情緒調節之中樞神經機制，我覺得與會者一下子都能透過海報大綱了解我們研究所要表達的核心意義; 但對 EEG (N2 是甚麼?, Left vs. Right frontal lobe 之功能, 相關之神經科學認知背景知識仍無法一下子了解)，這次大會與會者(報告者)都戰戰兢兢，事前也多做了萬分準備，要在短短的 15min 報告到讓他人能完全了解並不容易; 這次跑了幾個廳，感覺到每個場次的 Session Chair 真的很重要，有的可以凝聚來自不同國家參與者，使得一進入那廳場次每個人好像都認識你一般，有的就做得很分散，到最後因為部分團員太客氣內向就連提問都很少。

語言是參加國際會議必然面臨的，流利表達讓非屬此專業領域的學生(參與者)輕鬆了解並不很容易，並不是很多人一下子就了解我們的 data 節 t/6 有國內研究型大學已近成熟且有不錯的成果，而此認知實驗(如 EEG 與 ERP)應用於醫療照護與健康照護相關領域之實務型研究仍較為缺乏。我們的研究結果主要是要分享與會團體運動的介入：可以調變大腦對負向(悲傷)情緒的抑制能力

研究助理 [林恩次]

參與 Hong Kong International Conference on Education, Psychology and Society (HKICEPS)研討會，不管是行前或是會議中皆學習到許多。首先行前的海報製作與佈置，學習運用 Microsoft Power Point 編排、美觀，而製作的過程中也對於黃人珍老師的研究內容有更進一步的認知。

研討會過程中分為兩部分的研究分享：海報發表、口說發表。這一趟老師與我參加的是海報發表，也就是將海報展覽在會場，研究者們可以在會場中自行觀看不同的海報主題，有問題甚至可以直接與研究者討論,這真的是一個很棒的學術交流！另一個部分是口說發表，每位研究者在有限的時間內(每一位約 15 分鐘)，將自己的研究結果以簡報的方式與大家說明並分享，在報告結束時也會讓聽眾提出問題並討論。

其中印象最深刻的一場口說發表為：Impact of Parental Attitudes on Emotional Intelligence and Adjustment of Adolescents.作者採用隨機抽樣並藉由三份專業設計的量表，經過統整分析所得到的結果。作者詳細說明抽樣背景、研究結果準確度、研究過程的數據……，然而相關術語有些複雜難懂，但藉由這場報告讓我明白一份研究計畫是如何從頭到尾的誕生，也算是收穫。

研討會過程全程使用英文，因此部分內容在當下無法理解，但研討會後附有每一位參與者的研究結果之檔案，因此返國後可以繼續觀看研究結果並額外查詢相關資料，增進多方面的認知。而這樣的過程中，除了更深入老師的研究計劃，也參與到更寬廣的學術層面，是個很棒的經驗！

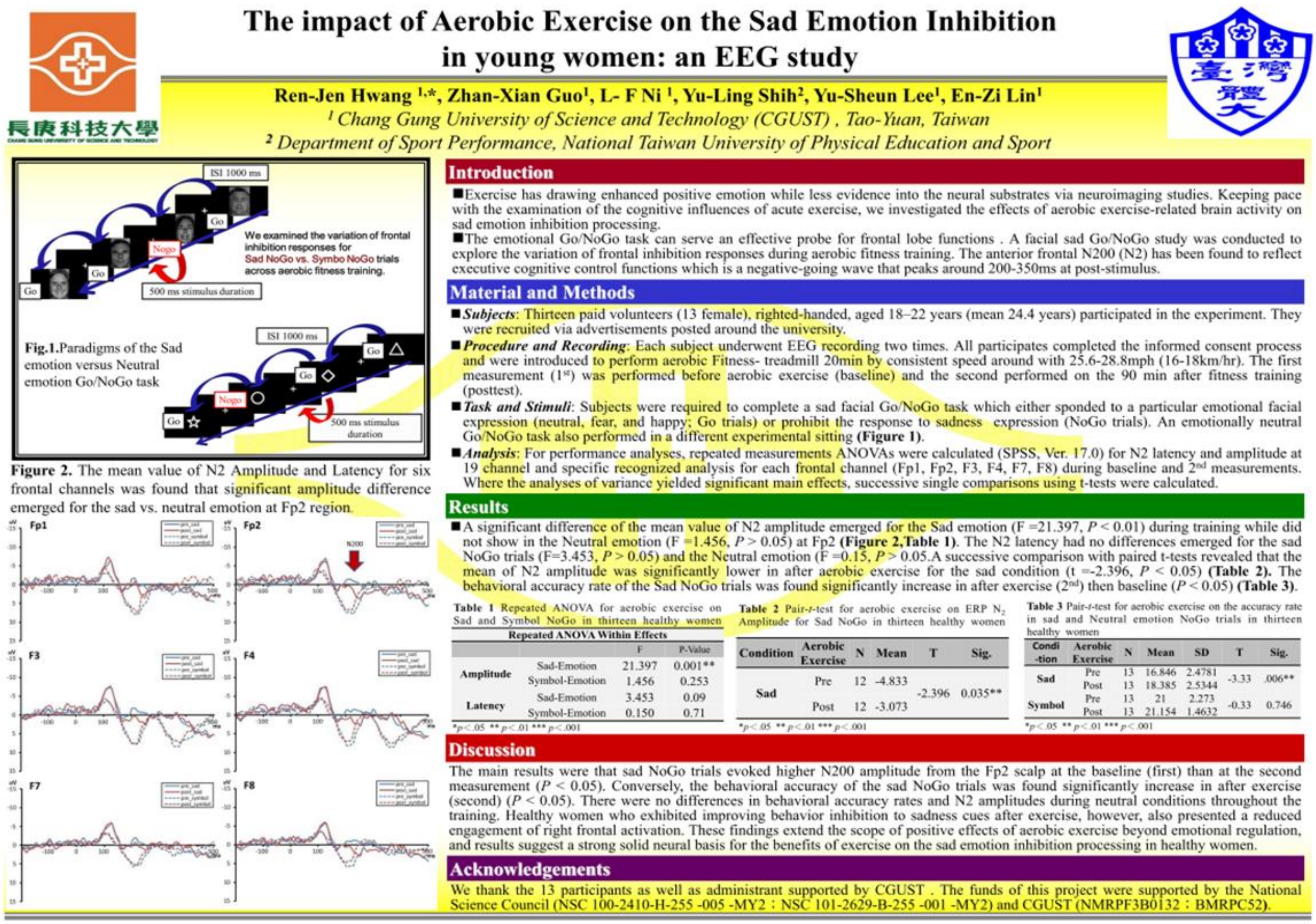
研討會讓我接觸並瞭解到國際觀，加倍體認到英文的重要性，對於日後學習英文的動力瞬間增加許多，是很棒的額外收穫。

學生認為參與此趟研討會，大大的改變並增進我對護理跨領域的認知！護理不僅僅是在醫院、診所當護理師；在學校當老師；或是在辦公室做研究，侷限在自己的工作崗位上，可以藉由個人或團體的研究結果發表，與世界各地的研究者分享、討論彼此的研究成果，衝擊出更多的想法與交流。每一位研究者的背景不盡相同，在這樣的狀態下，促成了多樣性題材的研究結果，讓我對於護理、社會心理學有了更廣泛的接觸，很開心接觸到這難能可貴的機會，參與了這麼棒的學術研討會，讓身為護理系學生的我在未來規劃，也有了更多不同的想法與出路！非常感謝此次帶我同行的黃人珍老師與其之研究計畫！

每一份行業如果都能找到興趣並付出努力，必能成為該科的專家！

摘要與海報發表 (ABSTRACT and POSTER)

Extensive research on humans suggests that aerobic exercise is associated with improving neurocognitive performance, overall physical and psychological health. The present study investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing in 13 healthy women by using 10-20 system electroencephalography (EEG). Facial emotional Go/NoGo tests were conducted to examine the variation of frontal inhibition responses for Sad NoGo versus Neutral NoGo trials across 20-min aerobic fitness training sessions. The first test was performed before aerobic exercise (baseline; first), and the second experiment was performed during absolute rest 30 minutes after the end of exercise training. The event-related potential (ERP) component N200 (N2) over the anterior frontal region was analyzed because it often reflects executive cognitive control functions. The main results were that sad NoGo trials evoked higher N200 amplitude from the FP2 scalp at the baseline (first) than at the second measurement (P < 0.05). Conversely, the behavioral accuracy of the sad NoGo trials was found significantly increase in after exercise (second) (P < 0.05). There were no differences in behavioral accuracy rates and N2 amplitudes during neutral conditions throughout the training. Healthy women who exhibited improving behavior inhibition to sadness cues after exercise, however, also presented a reduced engagement of right frontal activation. Exercise has been shown to benefit brain function for several decades. The current EEG study provides the first evidence that aerobic exercises play a critical role in regulating the neural basis of sad emotion inhibition processing in healthy women.



The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study

Ren-Jen Hwang [1,*], Zhan-Xian Guo[1], L- F Ni [1], Yu-Ling Shih[2], Yu-Sheun Lee[1], En-Zi Lin[1]

[1] *Chang Gung University of Science and Technology (CGUST) , Tao-Yuan, Taiwan*

[2] *Department of Sport Performance, National Taiwan University of Physical Education and Sport*

Fig.1. Paradigms of the Sad emotion versus Neutral emotion Go/NoGo task

Figure 2. The mean value of N2 Amplitude and Latency for six frontal channels was found that significant amplitude difference emerged for the sad vs. neutral emotion at Fp2 region.

Introduction

■Exercise has drawing enhanced positive emotion while less evidence into the neural substrates via neuroimaging studies. Keeping pace with the examination of the cognitive influences of acute exercise, we investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing.

■The emotional Go/NoGo task can serve an effective probe for frontal lobe functions . A facial sad Go/NoGo study was conducted to explore the variation of frontal inhibition responses during aerobic fitness training. The anterior frontal N200 (N2) has been found to reflect executive cognitive control functions which is a negative-going wave that peaks around 200-350ms at post-stimulus.

Material and Methods

■***Subjects***: Thirteen paid volunteers (13 female), righted-handed, aged 18–22 years (mean 24.4 years) participated in the experiment. They were recruited via advertisements posted around the university.

■***Procedure and Recording***: Each subject underwent EEG recording two times. All participates completed the informed consent process and were introduced to perform aerobic Fitness- treadmill 20min by consistent speed around with 25.6-28.8mph (16-18km/hr). The first measurement (1st) was performed before aerobic exercise (baseline) and the second performed on the 90 min after fitness training (posttest).

■***Task and Stimuli***: Subjects were required to complete a sad facial Go/NoGo task which either sponded to a particular emotional facial expression (neutral, fear, and happy; Go trials) or prohibit the response to sadness expression (NoGo trials). An emotionally neutral Go/NoGo task also performed in a different experimental sitting **(Figure 1)**.

■***Analysis***: For performance analyses, repeated measurements ANOVAs were calculated (SPSS, Ver. 17.0) for N2 latency and amplitude at 19 channel and specific recognized analysis for each frontal channel (Fp1, Fp2, F3, F4, F7, F8) during baseline and 2nd measurements. Where the analyses of variance yielded significant main effects, successive single comparisons using t-tests were calculated.

Results

■A significant difference of the mean value of N2 amplitude emerged for the Sad emotion (F =21.397, $P < 0.01$) during training while did not show in the Neutral emotion (F =1.456, $P > 0.05$) at Fp2 **(Figure 2,Table 1)**. The N2 latency had no differences emerged for the sad NoGo trials (F=3.453, $P > 0.05$) and the Neutral emotion (F =0.15, $P > 0.05$.A successive comparison with paired t-tests revealed that the mean of N2 amplitude was significantly lower in after aerobic exercise for the sad condition (t =-2.396, $P < 0.05$) **(Table 2).** The behavioral accuracy rate of the Sad NoGo trials was found significantly increase in after exercise (2nd) then baseline ($P < 0.05$) **(Table 3).**

Table 1 Repeated ANOVA for aerobic exercise on Sad and Symbol NoGo in thirteen healthy women

Repeated ANOVA Within Effects

		F	P-Value
Amplitude	Sad-Emotion	21.397	0.001**
	Symbol-Emotion	1.456	0.253
Latency	Sad-Emotion	3.453	0.09
	Symbol-Emotion	0.150	0.71

*p<.05 **p<.01 ***p<.001

Table 2 Pair-*t*-test for aerobic exercise on ERP N_2 Amplitude for Sad NoGo in thirteen healthy women

Condition	Aerobic Exercise	N	Mean	T	Sig.
Sad	Pre	12	-4.833	-2.396	0.035**
	Post	12	-3.073		

*p<.05 **p<.01 ***p<.001

Table 3 Pair-*t*-test for aerobic exercise on the accuracy rate in sad and Neutral emotion NoGo trials in thirteen healthy women

Condi-tion	Aerobic Exercise	N	Mean	SD	T	Sig.
Sad	Pre	13	16.846	2.4781	-3.33	.006**
	Post	13	18.385	2.5344		
Symbol	Pre	13	21	2.273	-0.33	0.746
	Post	13	21.154	1.4632		

*p<.05 **p<.01 ***p<.001

Discussion

The main results were that sad NoGo trials evoked higher N200 amplitude from the Fp2 scalp at the baseline (first) than at the second measurement ($P < 0.05$). Conversely, the behavioral accuracy of the sad NoGo trials was found significantly increase in after exercise (second) ($P < 0.05$). There were no differences in behavioral accuracy rates and N2 amplitudes during neutral conditions throughout the training. Healthy women who exhibited improving behavior inhibition to sadness cues after exercise, however, also presented a reduced engagement of right frontal activation. These findings extend the scope of positive effects of aerobic exercise beyond emotional regulation, and results suggest a strong solid neural basis for the benefits of exercise on the sad emotion inhibition processing in healthy women.

Acknowledgements

We thank the 13 participants as well as administrant supported by CGUST . The funds of this project were supported by the National Science Council (NSC 100-2410-H-255 -005 -MY2 ; NSC 101-2629-B-255 -001 -MY2) and CGUST (NMRPF3B0132 ; BMRPC52).

國科會補助專題研究計畫出席國際學術會議心得報告

日期：103 年 7 月 30 日

計畫編號	NSC 101-2629-B-255 -001 -MY2		
計畫名稱	**運動介入於婦女經前症狀，認知功能，情緒調節之腦電波研究**		
出國人員姓名	黃人珍 林恩次	服務機構及職稱	長庚科技大學
會議時間	102 年 12 月 19 日至 102 年 12 月 20 日	會議地點	香港機場 Regal airport hotel B1 國際會議廳
會議名稱	(中文)香港教育學、心理學暨社會學之國際研討會 (英文) Hong Kong International Conference on Education, Psychology and Society		
發表題目	(中文) 運動介入對悲傷情緒調節之腦波變化 (英文) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study		

■ 參加會議經過與會心得

計劃主持人[黃人珍]

這次本人與研究參與學生林恩次共同赴香港參加一年一度之教育、心理、社會國際研討會(Hong Kong International Conference on Education, Psychology and Society; HKICEPS 2013)，此國際研討會涵蓋了五個主要的學術專業領域的研究報告，(1)HKICEPS (2)Electrical Engineering and Computer Sciences; EECS (3) Symposium on Social Sciences; TISSS (4)Electrical Engineering and Computer Sciences; EECS (5)Engineering and Applied Science; HKICEAS。研習會為期兩天，在聖誕節的前夕 12 月 19 及 20 日，於香港機場 Regal airport hotel B1 國際會議廳舉行，而此次我們所發表的研究結果有兩份，主題分別為 (1) Resting Beta Power Correlates with Impulsivity Strength in Menopausal Women: An Electroencephalography Study (2) The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study，在研討會的現場除了海報展示我們的研究成果之外，另外的時間我們是在 B1「巴黎廳」聽 Psychology 及「東京廳」聽 Education、 Psychology 相關研究的發表;以前雖然有不少投稿國外研習會的經驗，但都因公務窒礙難行，這次是我第一次親赴研討會現場經驗到各國不同相關領域研究愛好者對其研究結果的分享，參與心理學與教育場次的研究者有來自美國、澳洲、中國大陸、日本外，也有不少來自印度、菲律賓及我們台灣的學術或教育團體。

從開始計畫參與此次國際研討會之初，在台灣就必須做許多前置作業，這次的兩篇海報發表，就美編及內容上，可見我們是現場上最閃亮的兩張。以神經造影工具探究腦科學的認知功能於國內外已行之有年，我們的研究主題與他人之不同主要是以 EEG 探討「運動介入」於情緒調節之中樞神經機制，我覺得與會者一下子都能透過海報大綱了解我們研究所要表達的核心意義; 但對 EEG (N2 是甚麼?, Left vs. Right frontal lobe 之功能, 相關之神經科學認知背景知識仍無法一下子了解)，這次大會與會者(報告者)都戰戰兢兢，事前也多做了萬分準備，要在短短的 15min 報告到讓他人能完全了解並不容易; 這次跑了幾個廳，感覺到每個場次的 Session Chair 真的很重要，有的可以凝聚來自不同國家參與者，使得一進入那廳場次每個人好像都認識你一般，有的就做得很分散，到最後因為部分團員太客氣內向就

連提問都很少。

語言是參加國際會議必然面臨的，流利表達讓非屬此專業領域的學生(參與者)輕鬆了解並不很容易，並不是很多人一下子就了解我們的 data 節 t/6 有國內研究型大學已近成熟且有不錯的成果，而此認知實驗(如 EEG 與 ERP)應用於醫療照護與健康照護相關領域之實務型研究仍較為缺乏。我們的研究結果主要是要分享與會團體運動的介入：可以調變大腦對負向(悲傷)情緒的抑制能力

研究助理 [林恩次]

參與 Hong Kong International Conference on Education, Psychology and Society (HKICEPS)研討會，不管是行前或是會議中皆學習到許多。首先行前的海報製作與佈置，學習運用 Microsoft Power Point 編排、美觀，而製作的過程中也對於黃人珍老師的研究內容有更進一步的認知。

研討會過程中分為兩部分的研究分享：海報發表、口說發表。這一趟老師與我參加的是海報發表，也就是將海報展覽在會場，研究者們可以在會場中自行觀看不同的海報主題，有問題甚至可以直接與研究者討論，這真的是一個很棒的學術交流！另一個部分是口說發表，每位研究者在有限的時間內(每一位約 15 分鐘)，將自己的研究結果以簡報的方式與大家說明並分享，在報告結束時也會讓聽眾提出問題並討論。

其中印象最深刻的一場口說發表為：Impact of Parental Attitudes on Emotional Intelligence and Adjustment of Adolescents.作者採用隨機抽樣並藉由三份專業設計的量表，經過統整分析所得到的結果。作者詳細說明抽樣背景、研究結果準確度、研究過程的數據……，然而相關術語有些複雜難懂，但藉由這場報告讓我明白一份研究計畫是如何從頭到尾的誕生，也算是收穫。

研討會過程全程使用英文，因此部分內容在當下無法理解，但研討會後附有每一位參與者的研究結果之檔案，因此返國後可以繼續觀看研究結果並額外查詢相關資料，增進多方面的認知。而這樣的過程中，除了更深入老師的研究計劃，也參與到更寬廣的學術層面，是個很棒的經驗！

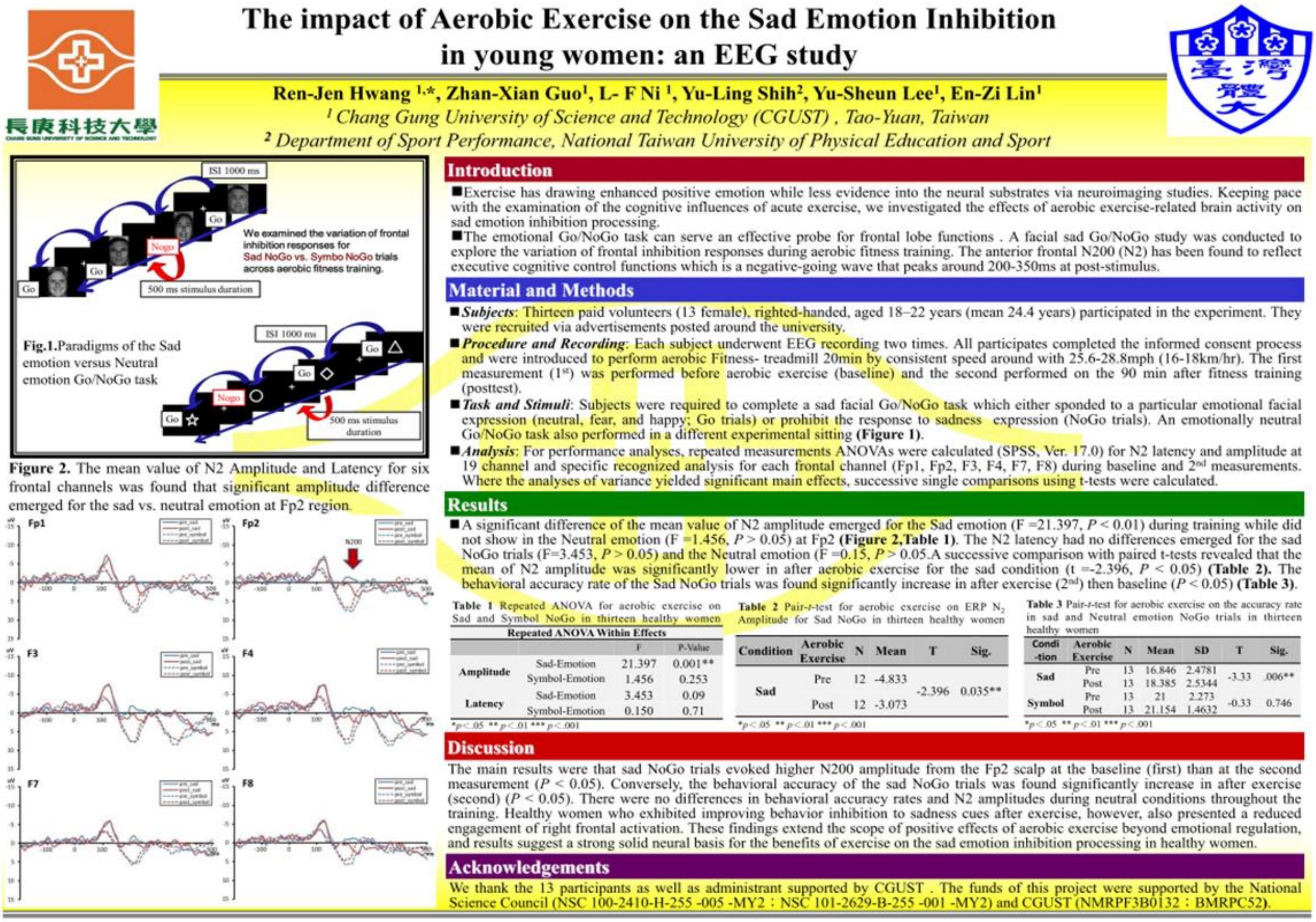
研討會讓我接觸並瞭解到國際觀，加倍體認到英文的重要性，對於日後學習英文的動力瞬間增加許多，是很棒的額外收穫。

學生認為參與此趟研討會，大大的改變並增進我對護理跨領域的認知！護理不僅僅是在醫院、診所當護理師；在學校當老師；或是在辦公室做研究，侷限在自己的工作崗位上，可以藉由個人或團體的研究結果發表，與世界各地的研究者分享、討論彼此的研究成果，衝擊出更多的想法與交流。每一位研究者的背景不盡相同，在這樣的狀態下，促成了多樣性題材的研究結果，讓我對於護理、社會心理學有了更廣泛的接觸，很開心接觸到這難能可貴的機會，參與了這麼棒的學術研討會，讓身為護理系學生的我在未來規劃，也有了更多不同的想法與出路！非常感謝此次帶我同行的黃人珍老師與其之研究計畫！

每一份行業如果都能找到興趣並付出努力，必能成為該科的專家！

摘要與海報發表 (ABSTRACT and POSTER)

Extensive research on humans suggests that aerobic exercise is associated with improving neurocognitive performance, overall physical and psychological health. The present study investigated the effects of aerobic exercise-related brain activity on sad emotion inhibition processing in 13 healthy women by using 10-20 system electroencephalography (EEG). Facial emotional Go/NoGo tests were conducted to examine the variation of frontal inhibition responses for Sad NoGo versus Neutral NoGo trials across 20-min aerobic fitness training sessions. The first test was performed before aerobic exercise (baseline; first), and the second experiment was performed during absolute rest 30 minutes after the end of exercise training. The event-related potential (ERP) component N200 (N2) over the anterior frontal region was analyzed because it often reflects executive cognitive control functions. The main results were that sad NoGo trials evoked higher N200 amplitude from the FP2 scalp at the baseline (first) than at the second measurement (P < 0.05). Conversely, the behavioral accuracy of the sad NoGo trials was found significantly increase in after exercise (second) (P < 0.05). There were no differences in behavioral accuracy rates and N2 amplitudes during neutral conditions throughout the training. Healthy women who exhibited improving behavior inhibition to sadness cues after exercise, however, also presented a reduced engagement of right frontal activation. Exercise has been shown to benefit brain function for several decades. The current EEG study provides the first evidence that aerobic exercises play a critical role in regulating the neural basis of sad emotion inhibition processing in healthy women.



科技部補助計畫衍生研發成果推廣資料表

日期:2014/11/01

科技部補助計畫	計畫名稱: 運動介入於婦女經前症狀, 認知功能, 情緒調節之腦電波研究
	計畫主持人: 黃人珍
	計畫編號: 101-2629-B-255-001-MY2　　學門領域: 性別主流科技計畫
無研發成果推廣資料	

101 年度專題研究計畫研究成果彙整表

計畫主持人：黃人珍	計畫編號：101-2629-B-255-001-MY2
計畫名稱：運動介入於婦女經前症狀，認知功能，情緒調節之腦電波研究	

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	1	1	100%		
		專書	0	0	100%		
	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	0	0	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	1	100%	篇	撰寫中
		研究報告/技術報告	0	0	100%		
		研討會論文	3	3	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。)	Published Conference poster presentation Ren-Jen Hwang*, Zhan-Xian Guo, Lee-Fen Ni, Yu-Ling Shih, Yu-Sheun Lee, En-Zi Lin (2013, Dec). The impact of Aerobic Exercise on the Sad Emotion Inhibition in young women: an EEG study . Hong Kong International Conference on Education, Psychology and Society (HKICEPS) ISBN:978-986-87417-3-7 , Hong Kong. Ren-Jen Hwang, Hsin-Ju Chen , L- F Ni , Yu-Ling Shih（2004）. The Effect of Exercise on the Premenstrual syndrome. Sad Emotional Inhibition: EEG Studies. 國立政治大學：科技部「性別與科技研究計畫」發表討論會. Unpublished Conference Presentation Hsin-ju Chen, Jen-Ren Hwang*, Sheun-Yu Lee, Fen-Nee Ni and Chia-Yu Yen (2014, Aug). The different effects of aerobic exercise on recognition of sad facial expression in premenstrual syndrome: an Electroencephalography (EEG) study. 2014 The Asian Network for Public Opinion Research (ANPOR) Niigata, Japan, (Accepted). Ren-jen Hwang, Ju Hsin Chen, Sheun Yu Lee, Fen Lee Ni and Chia Yu Yen (2014, Aug). Exercise changes the neural bases od Sad emotion regulation associated with premenstrual syndrome in women: an EEG study. 2014 Asian Network for Public Opinion Research Conference Niigata, Japan, November 29-30, 2014 , Niigata, (Accepted)

	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）

   經前症候群(PMS)與經前不悅症(PMDD)兩者是不同的。PMS 的盛行率達百分之 75-80，而 PMDD 約 3-8%, 乃介於生育年齡的女性特別受到嚴重經前不適的影響，另外 PMS 與經痛(dysmenorrhea) 也是兩者不同的概念與定義，近五年來國內外以運用腦造影技術，多針對經痛與 PMDD 之大腦型態學或神經元之變化進行探討，本研究計畫在議題上尚屬創新。運動帶給有機體之正向影響，不論在身、心、社會層面都已有充分的實驗證據，然運動對「經前症候群」婦女之大腦功能或情緒調節系統上之生理測量，或腦造影實驗上，明顯缺乏。我們在結案報告中的三項研究結果，提供健康照護相關學術或醫療領域，正視與強調運動介入與適當處理經前症候群之重要性。