Original Article

# Exploring the Relationships of Physical Activity, Emotional Intelligence and Health in Taiwan College Students

Gladys Shuk-Fong Li[1], Frank J.H. Lu[2], Amy Hsiu-Hua Wang[1]

[1]*Graduate Institute of Sport and Leisure Education, National Chung Cheng University, Chiayi, TAIWAN*
[2]*Graduate Institute of Physical Education, National Taiwan Sport University, Taoyuan, TAIWAN*

The benefits of physical activity (PA) on health are well documented. However, inactivity among university students is prevalent. This study examined whether emotional intelligence (EI) was one of the possible underlying psychological mechanisms responsible for behavior change that may be associated with the low levels of effectiveness of PA interventions. The purposes of this study were: (1) to compare EI, health-related physical fitness (HRPF), and health-related quality of life (HRQL) for the different levels of PA in Taiwan college students; (2) to explore the predictability of PA levels, HRQL, and HRPF towards EI. A total of 599 Taiwan college students were assessed utilizing HRPF measurement, and two questionnaires including the Bar-On Emotional Quotient Inventory (EQ-I) and the Medical Outcomes Study 36-item Short-Form Health Survey (MOS SF-36). College participants who reported a *recommended* level of PA scored significantly higher than their *insufficient* and *inactive* counterparts in EI, and some measures of HRQL and HRPF. The variables of "physical activity", "mental health", "gender", "social function", and "flexibility" were found to be the best linear combination to significantly ($p < 0.05$) predict the EI of Taiwan college students. It was concluded that participation in PA might be an effective way to improve the physical, psychological, as well as emotional health of college students. Thus, the importance of increasing exercise participation at the college level should be reinforced and implemented. The findings provide a basis for research aimed at determining the causal relationship between EI and PA. [*J Exerc Sci Fit* • Vol 7 • No 1 • 55–63 • 2009]

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## Introduction

Engaging in regular physical activity (PA) is one of the best ways to improve general health, including physical, psychological, and emotional health. PA has become the prime health indicator; it plays an essential role in enhancing physical fitness and health-related behavior, prolonging life, improving health-related quality of life (HRQL), enhancing weight management, and lowering the risk of morbidity and mortality from diseases, and has a positive influence on various medical disorders (Sundblad et al. 2008; Pedersen & Saltin 2006; Brosnahan et al. 2004; World Health Organization [WHO] 2004; Vuori 1998). While PA is a pivotal factor on physical fitness (Chu & Huang 2005), Nieman (1998) indicated that low fitness level has become the most important indicator of all the risk factors for premature death.

The association of psychological health and moderate PA participation has been demonstrated in previous studies. Through reviewing population studies, narrative and quantitative (e.g. meta-analyses) research literature, Biddle et al. (2000) summarized that PA is associated with

Corresponding Author
Gladys Shuk-Fong Li, Graduate Institute of Sport and Leisure Education, National Chung Cheng University, 168 University Road, Chiayi 62102, TAIWAN.
Tel: (886) 931780540
Fax: (886) 52721070
E-mail: admsfl@ccu.edu.tw

more positive self-perception (Baker & Brownell 2000; Fox 2000), positive affect and mood (Baker & Brownell 2000; Biddle 2000), low-to-moderate anxiety-reducing effect, and decreased risks of developing clinical depression (Dishman et al. 2004; Biddle et al. 2000). Some researchers addressed the impact of PA on perceived health in students and found that persons attaining recommended PA guidelines were more likely to have better overall HRQL and perceived health status (Sundblad et al. 2008; Zahran et al. 2007; Brown et al. 2003).

Inactivity and sedentary lifestyles are prevalent throughout the global population (WHO 2004). Less than 60% of individuals globally achieve the minimum recommendation of 30 minutes a day of moderate-intensity PA. The PA levels of college students are currently below the levels thought to be sufficient to promote health benefits (Sundblad et al. 2008; Biddle & Chatzisarantis 1999). Statistics on Taiwan's population participating in physical or leisure activities show that only 24.8% of the population exercises regularly. The prevalence of inactivity among Taiwan college students has increased over the last decade; only 10.7% exercise regularly enough to the recommended level that can reap health benefits (Lin et al. 2006). Thus, those who are inactive may experience adverse health consequences early in life (Racette et al. 2007). Almost 25% of university freshman students have high cholesterol, high blood pressure and high uric acid, and 20% reported that they have metabolic-related syndrome such as triglyceride and blood sugar irregularities (Wang & Lu 2008), which indicates that the usually aging-related diseases are having an impact on younger individuals.

PA also plays an important role in enhancing the emotional health of individuals. Emotions are an integral and significant aspect of human nature and the motivation for behavior. According to Goleman (1995), being able to monitor and regulate one's own feelings, understand the feelings of others, and use that "emotion" or "feeling" knowledge to guide thoughts and actions is known as emotional intelligence (EI). EI is the ability to perceive, integrate, understand, and manage emotions (BarOn 2002), which are concerned with understanding oneself and others, relating to people, and adapting to and coping more successfully with environmental demands. EI is, therefore, an important indicator of future success in many aspects of life (BarOn 2002; Saarni 1999; Goleman 1995).

Many researchers attribute the following emotional benefits to regular PA (Hellison 2003; Leith 2002; Kerr & Kuk 2001; Baker & Brownell 2000; Biddle 2000; ASCM 1998; Fox 1990; Sonstroem & Morgan 1989): enhanced positive and pleasant emotions (Turnbull & Wolfson 2002; Kerr & Kuk 2001; Sonstroem & Morgan 1989; Berger & Owen 1988), positive mood and more moderate anxiety-reduction effects (Biddle 2000), elevating sense of happiness (Szabo 2003), and higher levels of optimism (Kavussanu & Mcauley 1995).

There has been no study on the correlation between PA and EI; the emotional domain of PA has been overlooked in the past. Taymoori and Lubans (2008) suggested that the lack of knowledge regarding the mechanisms responsible for behavior change may explain the low levels of effectiveness in PA interventions among individuals. In an exploratory approach, the basic inquiries of this study were to explore whether EI could be one of the potential underlying mechanisms of PA behavior in Taiwan college students, and to ascertain the associations of PA, EI, and health. In an attempt to raise the awareness of university physical education teachers and PA professionals towards the utmost importance of the realization of the physical, psychological, and emotional domain of PA towards health, the specific purposes of this study were: (1) to compare EI, HRQL, and health-related physical fitness (HRPF) for the different levels of PA (*recommended*, *insufficient*, and *inactive*); and (2) to determine the predictability of some demographic variables, PA, HRQL, and HRPF towards EI.

## Methods

### *Subjects*

Student participants were recruited from two classes from each of four universities by randomly selecting two universities from four regions of Taiwan (Eastern, Northern, Southern, and Central). All subjects were full-time freshmen students who were asked to sign an informed consent form before filling in the *Demographic Form*, *BarOn EQ-I* (BarOn 2002), and *Short-form General Health Survey* (SF-36; Ware 2000). Subjects were asked to complete a Chinese version of the *Physical Activity Readiness Questionnaire* (PAR-Q; Canadian Society for Exercise Physiology, 2002) before some measures of physical fitness tests were administered.

Following the guidelines from the study of Brown et al. (2003) who analyzed data from the *Behavioral Risk Factor Surveillance System*, student participants were required to check one of three categories when responding to questions about their levels of PA on the *Demographic Form*. The simple criteria for categorizing students into three levels of activity groups were as

follows: (1) recommended (Rec) PA group: moderate exercise $\geq 30\ \text{min} \cdot \text{day}^{-1}$, $\geq 5$ days a week, or vigorous exercise $\geq 20\ \text{min} \cdot \text{day}^{-1}$, $\geq 3$ days a week; (2) insufficient (Ins) PA group: exercise irregularly, less than the recommended level but greater than none, not enough for gaining health benefit; (3) inactive (Ina) group: non-exercisers or sedentary. A total of 599 university students, including 105 Rec exercisers, 442 Ins exercisers, and 52 Ina exercisers (461 females, 138 males) were analyzed after discarding data that were incomplete.

### *Measuring instruments*

*BarOn EQ-I* (BarOn 2002), Medical Outcomes Study (MOS) SF-36 (Ware 2000) and HRPF tests were utilized in this study.

*HRPF*

The measurement of HRPF included the following: (1) 3-minute *Harvard Step Test* for measuring cardiovascular function; (2) body mass index (BMI) indicating body composition was obtained by measuring weight and height; (3) 1-minute sit ups for measuring muscular strength; and (4) *Sit and Reach Test* for measuring flexibility. After the above HRPF scores were obtained, each of the measured fitness scores were converted into standardized *z* scores by using the formula: X − M divided by SE (SD/√Z), and the total HRPF test scores was the sum of individual standardized *z* scores of BMI, muscular endurance, cardiovascular function, and flexibility scores.

*BarOn EQ-I*

EI was operationalized by the Hong Kong Chinese version of the *BarOn EQ-I*. The internal consistency of the subscales of the EQ-I ranged from 0.69 to 0.86. The *EQ-I* takes approximately 30–40 minutes to complete, and is suitable for individuals ≥ 16 years of age. Composed of 133 brief items, the *EQ-I* uses a 5-point self-rating Likert scale (ranging from "not true of me" to "true of me") measuring five factors: *intrapersonal*, *interpersonal*, *adaptability*, *stress management* and *general mood* (BarOn 2002). The Hong Kong Chinese version of the *BarOn EQ-I* was obtained from Multi-Health System Inc. (North Tonawanda, NY, USA), available via a Copyright License Agreement from them. Prior to this study, a pilot study was administered to a total of 450 college students from Taiwan, to examine the reliability and validity of the *BarOn EQ-I* for a sample of 378 Taiwan college students. Using the promax oblimin of principal axis, total explained variance was equal to 33%, which was a little lower than the result obtained from BarOn (2002); Cronbach's $\alpha$ of the overall EI was 0.95, and for the five subscales ranged from 0.64 to 0.90, indicating that the *BarOn EQ-I* has good reliability when used in Taiwan college subjects.

*MOS SF-36*

The SF-36 was developed to measure eight of the most commonly used dimensions in health surveys. SF-36 contains 36 items, and is scored on eight multi-item scales plus one item measuring a self-evaluated change in health status. The SF-36 is a generic measure, meaning that its concepts are not specific to any age (≥ 14 years old), disease, or treatment group. It is a self-reported general health status survey and is suitable for self-administration, needing only 5 minutes to fill in. The eight multi-item scales are: (1) physical functioning; (2) role limitations due to physical health problems; (3) bodily pain; (4) general health (GH); (5) vitality; (6) social functioning; (7) role limitation due to emotional problems; and (8) mental health (MH). The SF-36 scales were scored according to published scoring procedures, each expressed with values from 0 to 100 (0 = poor health) (Ware 2000). Based on a large sample of 18,142 subjects, Lu et al. (2002) revised the Taiwan version of the SF-36 and found good item discriminant validity with the item-scale correlation coefficients ranging from 0.40 to 0.83. Also, internal reliability was acceptable for all scales ($\alpha > 0.70$). These two results indicate that the Taiwan SF-36 has good psychometric properties for Taiwan subjects.

### *Statistical analysis*

SPSS version 10.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. The three different levels of PA groups (Rec, Ins, Ina) were the independent variables. EI, HRPF, and HRQL were the dependent variables. Two independent group analyses of variance (ANOVAs) were used to examine the differences in HRPF and HRQL among university students participating in different levels of PA. A one-way multivariate analysis of variance (MANOVA) for independent groups was computed to determine the differences in total EI scores among university students participating in different levels of PA. Univariate *F* (ANOVA) and *post hoc* analyses using the least significant difference (LSD) test were also performed for multiple comparisons of the three different levels of PA groups on the five EQ subscales. In addition, stepwise multiple regression analysis was used to explore the predictability of some demographic variables, PA levels, HRPF, and HRQL towards EI. The level of significance was set at 0.05 for all statistical analyses.

**Table 1.** Emotional intelligence, health-related physical fitness and health-related quality of life in the three levels of physical activity (PA) groups ($n = 599$)*

| | |
|---|---|
| Total emotional quotient | |
| Rec ($n = 105$) | 461.5 ± 51.2 |
| Ins ($n = 442$) | 450.1 ± 41.6 |
| Ina ($n = 52$) | 432.9 ± 43.2 |
| Intrapersonal | |
| Rec ($n = 105$) | 138.9 ± 17.9 |
| Ins ($n = 442$) | 133.1 ± 14.8 |
| Ina ($n = 52$) | 128.7 ± 14.8 |
| Interpersonal | |
| Rec ($n = 105$) | 104.6 ± 15.9 |
| Ins ($n = 442$) | 104.0 ± 11.6 |
| Ina ($n = 52$) | 100.0 ± 12.6 |
| Stess management | |
| Rec ($n = 105$) | 59.5 ± 7.5 |
| Ins ($n = 442$) | 57.4 ± 6.6 |
| Ina ($n = 52$) | 55.5 ± 7.3 |
| Adaptability | |
| Rec ($n = 105$) | 88.3 ± 10.2 |
| Ins ($n = 442$) | 85.6 ± 9.0 |
| Ina ($n = 52$) | 82.9 ± 8.6 |
| General mood | |
| Rec ($n = 105$) | 62.2 ± 9.7 |
| Ins ($n = 442$) | 60.1 ± 7.6 |
| Ina ($n = 52$) | 57.7 ± 8.7 |
| Total fitness | |
| Rec ($n = 105$) | 0.86 ± 1.78 |
| Ins ($n = 442$) | −0.16 ± 1.92 |
| Ina ($n = 52$) | 0.39 ± 3.11 |
| Body mass index | |
| Rec ($n = 105$) | 0.07 ± 0.97 |
| Ins ($n = 442$) | −0.03 ± 0.97 |
| Ina ($n = 52$) | 0.11 ± 1.31 |
| Strength | |
| Rec ($n = 105$) | 0.40 ± 0.95 |
| Ins ($n = 442$) | −0.04 ± 0.97 |
| Ina ($n = 52$) | −0.46 ± 1.05 |
| Flexibility | |
| Rec ($n = 105$) | 0.05 ± 0.83 |
| Ins ($n = 442$) | −0.04 ± 0.72 |
| Ina ($n = 52$) | 0.22 ± 2.39 |
| Cardiovascular function | |
| Rec ($n = 105$) | 0.47 ± 1.03 |
| Ins ($n = 442$) | −0.11 ± 0.95 |
| Ina ($n = 52$) | −0.03 ± 1.10 |
| General health | |
| Rec ($n = 105$) | 65.9 ± 14.5 |
| Ins ($n = 442$) | 59.3 ± 14.6 |
| Ina ($n = 52$) | 57.5 ± 18.8 |
| Mental health | |
| Rec ($n = 105$) | 66.5 ± 13.9 |
| Ins ($n = 442$) | 62.4 ± 14.0 |
| Ina ($n = 52$) | 60.8 ± 16.3 |
| Physical functioning | |
| Rec ($n = 105$) | 74.7 ± 18.0 |
| Ins ($n = 442$) | 74.4 ± 15.4 |
| Ina ($n = 52$) | 75.9 ± 13.3 |
| Role-physical | |
| Rec ($n = 105$) | 83.3 ± 29.1 |
| Ins ($n = 442$) | 79.6 ± 30.8 |
| Ina ($n = 52$) | 85.1 ± 27.7 |
| Social functioning | |
| Rec ($n = 105$) | 71.8 ± 19.1 |
| Ins ($n = 442$) | 72.8 ± 17.5 |
| Ina ($n = 52$) | 71.9 ± 19.6 |
| Bodily pain | |
| Rec ($n = 105$) | 70.3 ± 17.6 |
| Ins ($n = 442$) | 69.4 ± 17.4 |
| Ina ($n = 52$) | 71.2 ± 18.4 |
| Vitality | |
| Rec ($n = 105$) | 54.8 ± 15.3 |
| Ins ($n = 442$) | 52.0 ± 14.0 |
| Ina ($n = 52$) | 52.1 ± 16.7 |
| Role-emotional | |
| Rec ($n = 105$) | 76.2 ± 36.9 |
| Ins ($n = 442$) | 69.8 ± 38.3 |
| Ina ($n = 52$) | 64.7 ± 41.4 |

*Data presented as mean ± standard deviation. Rec = recommended PA group; Ins = insufficient PA group; Ina = inactive group.

## Results

Of the 599 university freshman subjects, 17.5% were categorized into the Rec PA group, 73.7% into the Ins group, and 8.6% into the Ina group. The descriptive data of the subjects are presented in Table 1.

### *PA and EI*

Wilks' lambda value of total EI for the three PA groups was significant ($\Lambda = 0.931$, $p < 0.05$), indicating that the Rec, Ins, and Ina groups differed in overall EQ scores. The univariate $F$ ratios (one-way ANOVA) comparing the three PA groups with regard to total EQ and the five EQ subscale measures are presented in Table 2. There was a significant difference ($p < 0.05$) in the three PA groups for the subscales of *intrapersonal*, *stress management*, *general mood* and *adaptability*; but no significant difference ($p > 0.05$) was found for the *interpersonal* subscale (Table 2). The *post hoc* tests of the three PA groups' multiple comparison LSD were

**Table 2.** Physical fitness of the three levels of physical activity groups

| HRPF | Mean ± SD | *F* | *p* | LSD |
|---|---|---|---|---|
| Total physical fitness | | 11.686 | 0.000* | Rec > Ins = Ina |
| Rec (*n* = 105) | 0.86 ± 1.78 | | | |
| Ins (*n* = 442) | −0.16 ± 1.92 | | | |
| Ina (*n* = 52) | 0.39 ± 3.11 | | | |
| Body mass index | | 0.791 | 0.454 | Rec = Ins = Ina |
| Rec (*n* = 105) | 0.07 ± 0.97 | | | |
| Ins (*n* = 442) | −0.03 ± 0.97 | | | |
| Ina (*n* = 52) | 0.11 ± 1.31 | | | |
| Strength | | 15.142 | 0.000* | Rec > Ins > Ina |
| Rec (*n* = 105) | 0.40 ± 0.95 | | | |
| Ins (*n* = 442) | −0.04 ± 0.97 | | | |
| Ina (*n* = 52) | −0.46 ± 1.05 | | | |
| Flexibility | | 1.669 | 0.189 | Rec = Ins = Ina |
| Rec (*n* = 105) | 0.058 ± 0.83 | | | |
| Ins (*n* = 442) | −0.04 ± 0.72 | | | |
| Ina (*n* = 52) | 0.21 ± 2.39 | | | |
| Cardiovascular function | | 14.850 | 0.000* | Rec > Ins = Ina |
| Rec (*n* = 105) | 0.47 ± 1.03 | | | |
| Ins (*n* = 442) | −0.11 ± 0.95 | | | |
| Ina (*n* = 52) | −0.03 ± 1.10 | | | |

*$p < 0.05$. HRPF = health-related physical fitness; SD = standard deviation; LSD = least significant difference test; Rec = recommended physical activity group; Ins = insufficient physical activity group; Ina = inactive group.

used to determine which pairs of means were significantly different. The mean subscale scores for *intrapersonal*, *stress management*, *general mood* and *adaptability* of the Rec PA group was significantly higher ($p < 0.05$) than that of the Ins and Ina groups. In turn, the EQ scores of the Rec and Ins PA groups were both significantly higher ($p < 0.05$) than that of the Ina group (Table 3).

### *PA and HRPF*

ANOVAs were utilized to analyze the sum *Z* fitness scores; it was found that variables of physical fitness total score, muscle strength and cardiovascular function were significantly different ($p < 0.05$) among the three different PA groups, but BMI and flexibility were not ($p > 0.05$).

Multiple comparisons showed that the Rec group scored significantly higher ($p < 0.05$) than the Ins and Ina groups on the variables of muscle strength and cardiovascular function, whereas the Ins group scored significantly higher ($p < 0.05$) than the Ina group (Rec > Ins > Ina). In addition, there was no significant difference ($p > 0.05$) among the three groups (Rec = Ins = Ina) for the variables of BMI and flexibility. With regard to total physical fitness scores, the Rec PA group scored significantly higher ($p < 0.05$) than their Ins and Ina counterparts, whereas no significant difference ($p > 0.05$) was found between the Ins and Ina groups (Rec > Ins = Ina) (Table 2).

### *PA and HRQL*

The results showed that there were significant differences ($p < 0.05$) in the variables of *GH* and *MH* among the three PA level groups. But there were no significant differences ($p > 0.05$) in the other six variables of *physical functioning*, *role physical*, *social functioning*, *bodily pain*, *vitality*, and *role functional* among the three groups. Multiple comparisons indicated that for the variables of *GH* and *MH*, the Rec group scored significantly higher ($p < 0.05$) than the Ins and Ina groups (Table 4).

### *Predictor variables of EI*

Stepwise multiple regression analyses were used to determine whether demographic varivables, PA, HRPF, and HRQL could predict overall EI. Basic assumptions were tested for the multiple linear regression analysis: the result of Durbin-Watson was 1.932, which is close to 2, and the histogram of the regression standardized residuals formed a normal curve. Therefore, the assumptions of linearity and homogeneity of variance for multiple regression were met.

The variables of PA, *MH*, *gender*, *GH*, and *strength* were found to be the best linear combination to

**Table 3.** Univariate *F* ratios comparing the emotional quotient (EQ) of the three levels of physical activity groups

| EQ subscales | Mean ± SD | *F* | *p* | *Post hoc* |
|---|---|---|---|---|
| Total EQ | | 7.574 | 0.001* | Rec > Ins > Ina |
| Rec (*n* = 105) | 461.5 ± 51.2 | | | |
| Ins (*n* = 442) | 450.1 ± 41.6 | | | |
| Ina (*n* = 52) | 432.9 ± 43.2 | | | |
| Intrapersonal | | 9.009 | 0.000* | Rec > Ins > Ina |
| Rec (*n* = 105) | 138.9 ± 17.9 | | | |
| Ins (*n* = 442) | 133.1 ± 14.8 | | | |
| Ina (*n* = 52) | 128.7 ± 14.8 | | | |
| Interpersonal | | 2.729 | 0.066* | Rec = Ins > Ina |
| Rec (*n* = 105) | 104.6 ± 15.9 | | | |
| Ins (*n* = 442) | 104.0 ± 11.6 | | | |
| Ina (*n* = 52) | 100.0 ± 12.6 | | | |
| Stess management | | 6.758 | 0.001* | Rec > Ins = Ina |
| Rec (*n* = 105) | 59.5 ± 7.5 | | | |
| Ins (*n* = 442) | 57.4 ± 6.6 | | | |
| Ina (*n* = 52) | 55.5 ± 7.3 | | | |
| Adaptability | | 6.618 | 0.001* | Rec > Ins > Ina |
| Rec (*n* = 105) | 88.3 ± 10.2 | | | |
| Ins (*n* = 442) | 85.6 ± 9.0 | | | |
| Ina (*n* = 52) | 82.9 ± 8.6 | | | |
| General mood | | 5.610 | 0.004* | Rec > Ins > Ina |
| Rec (*n* = 105) | 62.2 ± 9.7 | | | |
| Ins (*n* = 442) | 60.1 ± 7.6 | | | |
| Ina (*n* = 52) | 57.7 ± 8.7 | | | |

*$p < 0.05$. SD = standard deviation; Rec = recommended physical activity group; Ins = insufficient physical activity group; Ina = inactive group.

significantly ($p < 0.05$) predict the EI of Taiwan college students. Although standardized coefficient could not reflect the abosolute value of the predictability of each of the five variables towards EQ, it does have the discriminate function on comparing the importance of each of the significant predictors on their predictability value towards EQ (Table 5).

PA was the best predictor of EI ($\beta = 0.148$; $\beta^2 = 0.022$); PA had 0.005 ($\beta = 0.165$; $\beta^2 = 0.027$) higher predictability than *MH*, 0.016 ($\beta = -0.103$; $\beta^2 = 0.011$) higher predictability than *gender*, 0.014 ($\beta = 0.087$; $\beta^2 = 0.008$) higher predictability than *GH*, and 0.02 higher predictability than strength ($\beta = -0.082$; $\beta^2 = 0.007$). The equation of EI when predicting with these five variables is as follows:

$$EI = 393.197 + 0.457PA + 14.373MH - 10.748gender + 0.213GH - 3.607strength$$

This equation indicated that the five variables of *physical activity*, *MH*, *gender*, *general health*, and *strength* may play a role in predicting EI in Taiwan college students.

## Discussion

The benefits of regular PA on health are established; our results confirmed a possible association of regular PA, HRPF, and some measures of HRQL in Taiwan university students, and highlight the need for universities to increase students' participation in regular PA. Our findings are in line with those of Pedersen and Saltin (2006) and Brosnahan et al. (2004), that PA was linked with improved physical fitness, psychological wellbeing, and health-related behavior. The finding of this present study that the most active college students tend to have higher HRPF lend slight support to the finding of Chu and Huang (2005) that the exercise groups had significant improvements in HRPF over the inactive control group. Inactive college students appeared to have lower EI, HRPF, and perceived lower levels in their *GH* and *MH* in the present study, similar to the results of Sundblad et al. (2008) who found that physically inactive school students had low self-perception of their health status, as measured by HRQL and had higher stress levels.

In contrast to previous studies, we found no differences among the three activity groups for six variables

**Table 4.** Comparing the health-related quality of life (HRQL) of the three levels of physical activity groups

| HRQL | Mean ± SD | *F* | *p* | LSD |
|---|---|---|---|---|
| General health | | 9.262 | 0.000* | Rec > Ins > Ina |
| Rec (*n* = 105) | 65.9 ± 14.5 | | | |
| Ins (*n* = 442) | 59.3 ± 14.6 | | | |
| Ina (*n* = 52) | 57.5 ± 18.8 | | | |
| Mental health | | 4.176 | 0.016* | Rec > Ins > Ina |
| Rec (*n* = 105) | 66.5 ± 13.9 | | | |
| Ins (*n* = 442) | 62.4 ± 14.0 | | | |
| Ina (*n* = 52) | 60.8 ± 16.3 | | | |
| Physical functioning | | 0.222 | 0.801 | Rec = Ins = Ina |
| Rec (*n* = 105) | 74.7 ± 18.0 | | | |
| Ins (*n* = 442) | 74.4 ± 15.4 | | | |
| Ina (*n* = 52) | 75.9 ± 13.3 | | | |
| Role-physical | | 1.247 | 0.288 | Rec = Ins = Ina |
| Rec (*n* = 105) | 83.3 ± 29.1 | | | |
| Ins (*n* = 442) | 79.6 ± 30.8 | | | |
| Ina (*n* = 52) | 85.1 ± 27.7 | | | |
| Social functioning | | 0.163 | 0.850 | Rec = Ins = Ina |
| Rec (*n* = 105) | 71.8 ± 19.1 | | | |
| Ins (*n* = 442) | 72.8 ± 17.5 | | | |
| Ina (*n* = 52) | 71.9 ± 19.6 | | | |
| Bodily pain | | 0.326 | 0.722 | Rec = Ins = Ina |
| Rec (*n* = 105) | 70.3 ± 17.6 | | | |
| Ins (*n* = 442) | 69.4 ± 17.4 | | | |
| Ina (*n* = 52) | 71.2 ± 18.4 | | | |
| Vitality | | 1.507 | 0.222 | Rec = Ins = Ina |
| Rec (*n* = 105) | 54.8 ± 15.3 | | | |
| Ins (*n* = 442) | 52.0 ± 14.0 | | | |
| Ina (*n* = 52) | 52.1 ± 16.7 | | | |
| Role-emotional | | 1.810 | 0.165 | Rec = Ins = Ina |
| Rec (*n* = 105) | 76.2 ± 36.9 | | | |
| Ins (*n* = 442) | 69.8 ± 38.3 | | | |
| Ina (*n* = 52) | 64.7 ± 41.4 | | | |

*$p < 0.05$. SD = standard deviation; LSD = least significant difference test; Rec = recommended physical activity group; Ins = insufficient physical activity group; Ina = inactive group.

**Table 5.** Predicting emotional intelligence with demographic variables, physical activity (PA), health-related physical fitness, and health-related quality of life

| Variables | $R^2$ | Adjusted $R^2$ | Unstandardized coefficient | Standardized coefficient | *t* | *p* |
|---|---|---|---|---|---|---|
| PA | 0.035 | 0.033 | 0.457 | 0.148 | 40.71 | 0.000 |
| Mental health | 0.053 | 0.050 | 14.373 | 0.165 | 3.462 | 0.001 |
| Sex | 0.061 | 0.057 | −10.748 | −0.103 | 4.044 | 0.000 |
| General health | 0.068 | 0.062 | 0.213 | 0.087 | 2.504 | 0.013 |
| Strength | 0.075 | 0.067 | −3.607 | −0.082 | 2.042 | 0.042 |

Constant = 393.20; standard error of estimate = 9.66.

of the SF-36, including *physical functioning*, *role physical*, *social functioning*, *bodily pain*, *vitality*, and *role functional*. A possible reason for this might be that 90% of students consider themselves healthy even if they are not "feeling well" (Clausson & Berg 2003). The majority of university students might have a misconception in perceiving their health which is different from their health data examined—Sundblad et al. (2008)

reported a discrepancy between how students rated their health and their reported data from their physical checkup.

The emotional domain of PA has been overlooked in the past. In this study, it was found that university students whose time involvement in exercise reached the recommended level were found to have better total EI score and composite subscale scores for *intrapersonal*, *interpersonal*, *stress management*, *general mood* and *adaptability*, compared to the students in the Ins and Ina groups.

This study found that the higher the level of PA, the higher the *intrapersonal skill*, which is consistent with the finding from previous studies that PA has benefits on an individual's sense of self-worth, and self-perception (Asci 2003; Fox 2000). The positive association found between PA and *interpersonal skill* is also in line with the study of Smith (2000), who concluded that the more time a college student spent in PA, the higher their scores for *empathy*, *interpersonal relationship* and *social responsibility*. This research found that the more time a college student spent in PA, the higher the score for *stress management*. In explaining the relationship between stress management and PA, Dishman (1997) indicated that PA can stimulate the excretion of enkephalin and β-endorphins in humans, which can help in relieving the sensation of pain and pressure, resulting in improved mental balance. Thus, PA plays an important role in stress management. Finally, we found a positive relationship between PA and *total mood*, which is consistent with the previous findings that participating in PA can lower negative mood, uplift positive mood, and enhance an optimistic attitude (Szabo 2003; Kavussanu & Mcauley 1995).

Several plausible mechanisms for PA effects on emotion have been identified (Carron et al. 2003; Leith 2002; Biddle & Mutrie 2001), including improvements in fitness or weight loss (Fox 2000), increased endorphin production following exercise (Leith 2002), changes in central serotonergic systems from exercise, and exercise effects on neurotransmitters such as norepinephrine (Dishman 1997). Lastly, the possible psychological mechanism on positive emotional changes might result from changes in self-esteem due to mastering new exercise skills, or from an increased sense of intrapersonal control (Biddle 2000) or social support (Fox 2000).

EI is an important indicator of future success in many aspects of life (BarOn 2002; Saarni 1999; Goleman 1995). Our results indicated that the five variables *physical activity*, *MH*, *gender*, *GH*, and *strength* are associated with EI in Taiwan college students. Thus, in Taiwan college students, the higher the PA level, the higher the perception of being mentally healthy, the more likely to be female, have better general health and better strength fitness, and the higher the level of EI. These five predictors may play a role in predicting EI.

Our finding that PA may be a predictor of EI corresponds to the findings of many researchers (Hellison 2003; Leith 2002; Kerr & Kuk 2001; Baker & Brownell 2000; Biddle 2000; ASCM 1998; Fox 1990; Sonstroem & Morgan 1989), who confirmed a positive association between regular PA and emotional benefits. Mental health associated with EI is in line with the finding of Schutte et al. (2007) who indicated that EI had a significantly stronge association with mental health. The present finding lends slight support that gender is a significant predictor of EI, as females scored higher than males on emotional perception (Jausovee & Jausovee 2005; Kafetsios 2004).

One limitation of our study is that the Hong Kong Chinese *BarOn EQ-I* could not be revised for Taiwan University students with the restraint given by Multi-Health Systems Inc. under the MHS Agreement, although the Hong Kong Chinese version of the *BarOn EQ-I* is one of the most advanced self-report measures of EI currently available. Therefore, we cannot state whether the questionnaire is equally valid for Taiwan Chinese samples. The greatest limitation of our study is its cross-sectional design, which prevented us from establishing causality or directionality. Although we found positive relationships between PA and EI, we cannot state that PA causes good EI, because it is equally possible that PA is the effect of good EI, as people with good EI may simply be more likely to be active. Future research should aim to clarify this issue. Furthermore, to explore whether EI is a mediator of PA behavior is also suggested for further study.

In conclusion, college students who were physically more active at recommended levels were more likely to have higher EI, higher HRPF levels, and higher HRQL compared to their sedentary counterparts and those who engage in insufficient levels of PA. Furthermore, for Taiwan university students, the better their mental health and the higher their PA levels, the better their social skills, and the more flexible their physical fitness, the higher their levels of EI. The present study confirms that exercise participation enhances health and might be an effective way for college students to identify and manage EI. Thus, the importance of increasing exercise participation at the college level should be reinforced and implemented. The findings provide

a basis for research aimed at determining the causal relationship between EI and PA.

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