

Vigorous physical activity linked to anxiety and self-acceptance may suggest coping mechanisms across age groups: A preliminary finding

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This preliminary study examined the relationships between physical activity (PA), psychological well-being (consists of six dimensions), depression, anxiety, and stress, and whether these relationships might vary across young and mid adults. One hundred and twenty respondents aged between 18 to 55 years old completed the study through online questionnaires. The results revealed that overall, PA did not significantly correlate with psychological well-being, depression, anxiety, and stress. However, the relationships between moderate PA and two well-being dimensions (personal growth and self-acceptance, respectively) approached significance. Vigorous PA was significantly correlated with anxiety. Separate analyses by age group showed that, in young adults, moderate PA was slightly linked to lower personal growth, whilst higher level of vigorous PA was significantly linked to higher anxiety. In mid adults, higher vigorous PA significantly correlated with lower self-acceptance. These relationships may suggest vigorous PA as coping mechanisms across age groups when dealing with anxiety and self-acceptance.

KEY WORDS: Age, Anxiety, Depression, Exercise, Stress, Well-being.

Introduction

Any type of bodily movements (e.g., sports, occupational activities, and chores) that is produced by the body's skeletal muscles and results in energy expenditure is considered as physical activity (PA; Caspersen, Powell, & Christenson, 1985). Over the past 20 years, more and more studies have

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looked at the importance of PA, not only on physical health, but also, on mental health. Of all aspects of mental health, depression, stress, and anxiety were among the most commonly studied variables in relation to PA (Biddle & Asare, 2011; Dashti, Su, Esfehiani, & Esfehiani, 2014; Hassmen, Koivula, & Uutela, 2000; Netz, Wu, Becker, & Tenenbaum, 2005; Penedo & Dahn, 2005; Scully, Kremer, Meade, Graham, & Dudgeon, 1998; Wipfli, Rethorst, & Landers, 2008). For example, in Dashti, Su, Esfehiani, and Esfehiani (2014), low level of PA was significantly correlated with higher level of depression and stress. The same authors also indicated that individuals who are depressed are less likely to be physically active. College students who engaged in vigorous PA have been found to be less likely to report poorer mental health (VanKim & Nelson, 2013). Significant effects of moderate PA training in reducing symptoms of anxiety have also been reported (see Herring, Lindheimer, & O'Connor, 2013; Long & van Stavel, 1995 for reviews). Furthermore, light PA (e.g., walking) was also found to significantly predict better overall mental well-being among university students (Panahi et al., 2016). For a sample that covered a wider range of age group (i.e., young and older adults), Cooper and Barton (2016) has also reported that low level of PA is significantly correlated with low level of mental well-being.

The benefits of PA on mental well-being can be explained by the biopsychosocial model. According to the biological hypothesis, the underlying biological changes induced by PA is linked with increases in synaptic transmission of dopamine and serotonin - neurotransmitters that have effects similar to some antidepressants (Ho, Louie, Chow, Wong, & Ip, 2015). Furthermore, PA can cause endorphins release, easing pain and positive moods and feelings (Lubans et al., 2016). In addition, engaging in PA also increases the blood flow to the brain, prompting the release of endorphins (Donaghy, 2007). This suggests the possibilities of PA in general being a protector against depression. From the psychosocial perspective, challenging PA can lead to improvements in confidence, resiliency and self-efficacy in individuals, and these improvements can enhance the overall mental well-being and subsequently also reduce the risk of developing mental illnesses (Ho et al, 2015; Lubans et al., 2016). Lubans et al. (2016) also suggested that some aspects of mental well-being such as basic psychological needs, social connectedness, environmental mastery, self-acceptance, relatedness, purpose in life, and autonomy can be easily accomplished through engaging in PA. For example, PA promotes social interaction opportunities (relatedness; VanKim & Nelson, 2013), improvements in the perception of self (self-acceptance) and independence (autonomy).

Although growing literature has shown close links between physical

activity (PA) and mental well-being, indicating benefits of PA engagement in mental health (as reviewed in Biddle & Asare, 2011; Netz et al., 2005; Penedo & Dahn, 2005), this association nonetheless is not always consistent. For example, as reviewed in Mammen and Faulkner (2013), whilst evidence have shown that even light exercise (e.g., walking) can potentially prevent the development of depression, plenty of other studies have also shown no relationship between prevention of developing depression and PA. Moreover, Bonhauser et al. (2005) reported that frequent PA significantly reduced anxiety but not depression symptoms. However, Biddle and Asare (2011) found that PA has only small positive effects in reducing anxiety in young generation. In Rosenbaum, Tiedemann, Sherrington, Curtis, and Ward's (2014) systematic review on PA as interventions for those with mental illnesses, only 20 out of 39 studies reported large effects on depressive symptoms. In addition, Wu, Tao, Zhang, Zhang, and Tao (2015) reported that high level of PA was not significantly correlated with low depression and anxiety. Another systematic review has documented some studies reporting no association between PA and stress (see Kolehmainen & Sinha, 2014). These findings suggest that the relationship between PA and mental well-being remains inconclusive and findings have to be interpreted with care. No relationship between PA and mental well-being may not necessarily indicate no beneficial outcomes of PA on mental health, whilst low levels of PA may not necessarily indicate poor mental health.

On the other hand, in ageing studies, although an association has been found between PA and depressive symptoms, this association decreased with an increasing age, and with no obvious association evident in mid-adults (Pereira, Geoffroy, & Power, 2014). In Malaysia, it was found that physical activeness declines with age (Tam et al., 2016). Therefore, it is of great importance to also examine whether the aforementioned relationships, if present, might vary across age groups.

In summary, how different aspects of mental well-being are linked to PA and its level (i.e., light, moderate, or vigorous) need further explorations. Moreover, many of the past studies measured mental well-being as a whole entity without exploring its distinctive dimensions, that, individually is also an important component of a well-being. For example, if based on psychosocial perspectives, PA is linked to social connectedness due to opportunities for interactions, but the same correlation may not be as clear for other dimensions of well-being, which warrants further investigations. Moreover, any link that has been established between PA and mental well-being may also exist differently as one steps into different time point in life (e.g., from young to mid adulthood) due to age-related changes in lifestyle and percep-

tion towards life. Therefore, it is hypothesised that different levels of PA will be correlated with different dimensions of mental well-being, depression, anxiety, and stress. In addition, these relationships (if established) might vary across age groups.

Methods

The current study aimed to further examine the relationship between levels of PA (measured in terms of frequency and intensity) and mental well-being. Specifically, the mental well-being was measured using Ryff's Psychological Well-Being (Ryff & Keyes, 1995) which composed of six different dimensions (i.e., self-acceptance, purpose in life, personal growth, positive relations, environmental mastery, and autonomy). An additional separate scale measuring depression, anxiety, and stress was also included. This study was approved by the International Medical University (Malaysia) Joint-Committee on Research and Ethics [BPS I-01-17(18)2019]. All participants gave informed consent prior to participation.

PARTICIPANTS

This study employed a cross-sectional survey design. One hundred and twenty participants aged between 18 to 55 years old (83 females) were recruited from Kuala Lumpur and Selangor regions of Malaysia. Recruitment was based on word of mouth, social media, and opportunity sampling. All questionnaires were administrated online using Google forms. The whole survey took approximately 15-20 minutes to complete. All participants were reimbursed with a token of appreciation (i.e., RM 10 Cinemas E-vouchers) for their participation. Participants were required to provide some basic demographic information and their contact details (e.g., email address) in order to receive the reimbursement but this information was not identifiable with their questionnaires' responses. This was also to ensure they could only respond once as each reimbursement was only rewarded to each respondent.

MEASURES

International Physical Activity Questionnaire – Short (IPAQ-short).

The 7-question International Physical Activity Questionnaire – Short (IPAQ-short; IPAQ Research Committee, 2005) was used to measure the frequency (in days, hours per day, and minutes per day) of PA (happened at least 10 minutes at a time) that has been carried out in the past seven days. Questions one to two inquire about participation in vigorous PA (i.e., activities that take hard physical effort and make you breathe much harder than normal), such as heavy lifting, digging, aerobics or fast bicycling; questions three to four inquire about participation in moderate PA (i.e., activities that take moderate physical effort and make you breathe somewhat harder than normal), such as carrying light loads, bicycling at a regular pace, or double tennis; questions five to six inquire about participation in walking (includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure); the last question inquires about time spent sitting (includes time spent at work, at home, while doing course work and during

leisure time, time spent at a desk, visiting friends, reading, or sitting or lying down to watch television). The IPAQ-short has been consistently shown to have a high reliability, ranging from 0.66 to 0.88 (Lee, Macfarlane, Lam, & Stewart, 2011).

Ryff's Scales of Psychological Well-Being

The 18-item version Psychological Well-Being Scale (Ryff & Keyes, 1995) was used to measure the psychological well-being of the respondents. The scale consisted of six dimensions with three questions for each, and the respondents were required to respond according to a likert-scale of 1 (*strongly disagree*) to 6 (*strongly agree*). The six dimensions are namely self-acceptance (e.g., "I like most parts of my personality"), purpose in life (e.g., "Some people wander aimlessly through life, but I am not one of them"), personal growth (e.g., "For me, life has been a continuous process of learning, changing, and growth"), positive relations (e.g., "Maintaining close relationships has been difficult and frustrating for me"), environmental mastery (e.g., "The demands of everyday life often get me down"), and autonomy (e.g., "I tend to be influenced by people with strong opinions").

The Depression, Anxiety, Stress Scale- 21 (DASS-21).

The Depression, Anxiety, Stress Scale- 21 (DASS-21; Lovibond & Lovibond, 1995), was used to measure emotional distress in three sub categories: depression, anxiety and stress. The DASS-21 is a 21-item self-reporting questionnaire, with a total of seven items for each of the sub categories. The respondents were required to rate the scale based on a four-point rating scale, from 0 being "*did not apply to me at all*" to 3 being "*applied to me very much or most of the time*". The rating of each item is based on how much it is applicable to the respondents over the past seven days (e.g., "I found it hard to wind down", "I was aware of dryness of my mouth"). The DASS-21 has the reliability scores of Cronbach's alpha 0.91 for Depression subscale, 0.84 for Anxiety subscale and 0.90 for Stress subscale (Lovibond & Lovibond, 1995).

STATISTICAL ANALYSIS

Data entry and analysis were conducted using SPSS version 25 (IBM Corp., 2017). Pearson's R Correlation was used to examine the relationship between the variables at an alpha level of .05.

Results

Table I displays the demographic data of the respondents. Participants were only requested to provide their age in category: 18-35 or 36-55, thus no mean and standard deviation were calculated. Table 2 provides the descriptive statistics for the measured variables.

The Pearson correlation was conducted to determine the relationship between the measured variables. As shown in Table 3, overall, PA (i.e., total MET) was neither significantly correlated with psychological well-being, r

TABLE I
Demographic Data

		Age (years)	
		18-35	36-55
Gender	Male	15	22
	Female	45	38
Occupation	Student	34	0
	Employed	24	51
	Unemployed	2	9
Smoking	Yes	0	7
	No	60	53

TABLE II
Descriptive Statistics for Types of (PA), Dimensions of Psychological Well-Being, Depression, Anxiety, and Stress

	Minimum	Maximum	Mean	Std. Deviation
Vigorous MET	0	4800	552.33	749.92
Moderate MET	0	7200	312.00	708.34
Walking MET	0	8316	873.40	1285.97
Total MET	0	8853	1737.73	1649.94
Environmental Mastery	4	18	13.17	3.03
Personal Growth	5	18	14.78	2.47
Positive Relations	5	18	13.74	2.64
Autonomy	5	18	12.88	2.57
Purpose in life	7	18	12.68	2.46
Self-acceptance	5	18	13.58	2.76
Total PWB	55	102	80.83	10.17
Depression score	0	42	7.85	8.53
Anxiety score	0	30	8.53	7.47
Stress score	0	38	11.35	7.81
Total DAS	0	108	27.73	21.48

Note. MET, metabolic equivalent of task; PWB, psychological well-being; DAS, depression, anxiety and stress.

TABLE III
*Pearson Correlations (*r*) of the Types of PA with Dimensions of Psychological Well-Being, Depression, Anxiety and Stress (N = 120)*

	Vigorous MET	Moderate MET	Walking MET	Total MET
Environmental Mastery	.032	-.117	.026	-.016
Personal Growth	-.097	-.192*	.001	-.125
Positive Relations	-.003	-.101	-.132	-.147
Autonomy	-.058	-.109	.146	.040
Purpose in Life	-.067	.021	.098	.055
Self-acceptance	-.136	-.186*	.047	-.105
Total PWB	-.083	-.180*	.047	-.078
Depression	.069	.005	.059	.080
Anxiety	.192*	.077	.064	.171
Stress	.062	.012	.027	.054
Total DAS	.117	.033	.056	.111

* Correlation is significant at the .05 level (2-tailed).

(120) = $-.078$, $p = .395$, nor with depression, anxiety, and anxiety (i.e., DAS), $r(120) = .111$, $p = .228$. For levels of PA, relationship between moderate PA and psychological well-being approached significance, $r(120) = -.180$, $p = .049$, indicating higher moderate PA is linked to lower psychological well-being. Moreover, moderate PA was also significantly correlated with personal growth, $r(120) = -.192$, $p = .036$, and self-acceptance, $r(120) = -.186$, $p = .042$, indicating higher moderate PA is linked to lower level of both dimensions in psychological well-being. There was also a significant relationship between vigorous PA and anxiety, $r(120) = .192$, $p = .036$, indicating higher frequency of vigorous physical activity and higher anxiety is linked. All other variables were found not approaching significance, $p > .05$.

Young And Mid Adults

Further analysis was conducted to examine if the relationship between the measured variables vary for young and mid adults. Table 4 shows the correlation between the measured variables in young adults. The relationship between moderate PA and personal growth approached significance, $r(60) = -.261$, $p = .044$; higher PA is linked to lower personal growth. Furthermore, the relationship between vigorous PA and anxiety was also found to be significant, $r(60) = .333$, $p = .009$, indicating higher frequency of vigorous PA is linked to higher anxiety. For mid adults (as shown in Table 5), only the relationship between vigorous PA and self-acceptance was found to be significant, $r(60) = -.315$, $p = .014$, indicating higher frequency of vigorous PA and lower self-acceptance is linked. No other variables were found approaching significance in both age groups, all $ps > .05$.

TABLE IV
Pearson Correlations (r) of the Types of PA with Psychological Well-Being, Depression, Anxiety and Stress in Young Adults (aged 18-35, $N = 60$)

	Vigorous MET	Moderate MET	Walking MET	Total MET
Environmental Mastery	.146	-.170	.074	.036
Personal Growth	-.016	-.261*	.089	-.079
Positive Relations	.019	-.144	-.198	-.208
Autonomy	-.091	-.143	.145	-.013
Purpose in Life	-.052	.055	-.018	-.010
Self-acceptance	-.023	-.233	.053	-.093
Total PWB	.003	-.233	.032	-.096
Depression	.157	-.050	.119	.135
Anxiety	.333**	.099	-.003	.209
Stress	.190	.027	.032	.128
Total DAS	.253	.025	.059	.177

* Correlation is significant at the .05 level (2-tailed).

** Correlation is significant at the .01 level (2-tailed).

TABLE V
Pearson Correlations (r) of the Types of PA with Psychological Well-Being, Depression, Anxiety and Stress in Mid Adults (aged 36-55, N = 60)

	Vigorous MET	Moderate MET	Walking MET	Total MET
Environmental Mastery	-.102	.016	-.029	-.063
Personal Growth	-.216	-.167	-.071	-.186
Positive Relations	-.019	.060	-.053	-.040
Autonomy	.018	-.018	.146	.130
Purpose in Life	-.068	-.108	.210	.150
Self-acceptance	-.315*	-.079	.037	-.114
Total PWB	-.196	-.059	.061	-.040
Depression	-.057	.136	.006	.012
Anxiety	-.009	.024	.139	.121
Stress	-.127	-.054	.028	-.039
Total DAS	-.071	.042	.059	.031

* Correlation is significant at the .05 level (2-tailed).

Discussion

The current study aimed to examine the relationships between PA, psychological well-being, depression, anxiety, and stress. The study also set to further examine how the aforementioned relationships, if present, might vary in young and mid adults. In general, the findings revealed non-significant relationships between PA, psychological well-being, depression, anxiety, and stress. However, to our surprise, when looking at the levels of PA, it was revealed that moderate PA was negatively correlated with overall psychological well-being. This relationship was contributed by two of the dimensions in psychological well-being (i.e., personal growth and self-acceptance). This indicates that more frequent moderate PA is linked to lower level of personal growth and self-acceptance. Additionally, more frequent vigorous PA is significantly linked to higher level of anxiety. When the same analysis was done separately for young and mid adults, findings revealed differential relationships. In young adults, more frequent moderate PA is linked to lower level of personal growth. Moreover, the positive relationship between vigorous PA and anxiety intensified. These correlations did not exist in the mid-adult age group. Nonetheless, more frequent vigorous PA is linked to lower level of self-acceptance in mid adults. As for non-significant relationships found between PA, depression and stress, although not as hypothesised, the current study replicated some past findings (e.g., Aine & Lester, 1995; Chacón-Cuberos et al., 2019; Hawker, 2012; Nguyen-Michel, Unger, Hamilton, & Spruijt-Merz, 2006; Toseeb et al., 2014). It is also worth pointing out that some of the past studies that reported relationships between PA and depres-

sion or stress have also included participants who experienced moderate or severe depression and/or stress (e.g., Chekroud et al., 2018; Dashti et al., 2014), whom might have a larger room to benefit from PA. In the current study, the sample was composed of a non-clinical population. As shown in Table 2, the mean for depression and stress scores were both under the normal range, whilst the mean for anxiety score indicates mild severity.

These findings are interesting, as the direction of the observed significant relationships were not as what most past studies have shown. Whilst past studies have shown more frequent PA is associated with better mental well-being (e.g., Edwards, Palavar, Ngcobo, & Edwards, 2005; Hassmen et al., 2000), our findings showed otherwise, specifically with personal growth and self-acceptance. Some past studies also reported that more frequent PA is correlated with decreased anxiety (see Wipfli et al., 2008 for a review), but the current study observed an opposite direction and replicated the findings reported in Legey et al. (2017). Instead of questioning the positive outcomes of PA on mental well-being, we argued that PA may be treated as coping mechanisms when dealing with mental issues (e.g., anxiety). This is particularly obvious in young adults: engaging in vigorous PA possibly to cope with anxiety. This speculation can be further supported by an animal model where rats and mice have been reported to engage in defensive burying (a behaviour similar to digging - vigorous activity) when anxious (Binder, Droste, Ohl, & Reul, 2004; Steimer, 2011). In the current study, more than 50% of the young adults recruited were university students, in which anxiety about assessments and performance can be quite common. An additional independent *t*-test was conducted to compare the anxiety level between young and mid adults and it was found that the anxiety level was significantly higher in young adults, $t(118) = 2.235$, $p = .027$ (two-tailed), Cohen's $d = 0.408$. Therefore, our argument that young adults, who are more anxious, tend to be involved in more vigorous PA makes sense since PA has been reported to be a common coping mechanism when dealing with mental issues (Garber, 2017) and reduced anxiety symptoms in young people (Bonhauser et al., 2005). Besides, in the clinical population, empirical evidence has also shown that high intensity exercise is more effective in treating patients with anxiety (Aylett, Small, & Bower, 2018).

The current findings also revealed that more frequent moderate PA was linked to lower level of personal growth in young adults. In the Ryff's Scale of Psychological Well-Being, personal growth was characterised by the perception that life needs continuous learning, changing, growth, new experience and challenges, and efforts for improvements. In the current study, it might be the case that young adults who are low in personal growth seek for

challenges and self-development through engagement in PA for a change in life (Allender, Hutchinson, & Foster, 2008).

As for mid adults, more frequent vigorous PA significantly linked to lower level of self-acceptance could be interpreted as differential coping mechanism in different stages in life. The dimension of self-acceptance in Ryff's Scale of Psychological Well-Being captures one's acceptance of own personality and life achievements. At the age of mid adulthood (i.e., 36-55 years old in the current study), perhaps those who are not pleased with their achievements in life strive for something else to achieve (e.g., better health and body image) with active engagements in PA. This speculation is based on the findings of a 2-year longitudinal study which reported that middle-aged women who continued to actively engage in PA can enhance their perception towards their own self-esteem, body condition and attractiveness (Elavsky, 2010). In the current study, more than 60% of the mid-adult participants were female, which might have largely contributed to the correlations observed between vigorous PA and self-acceptance (i.e., a construct that can lead to self-esteem).

Although our findings did not reflect beneficial relationships between PA and overall mental well-being, the positive outcomes of regular PA on mental health as reported in past studies (e.g., Chekroud et al., 2018; Ketunen, 2015; Mason & Kearns, 2013; Meyer, Castro-Schilo, & Aguilar-Gaxiola, 2014; Penedo & Dahn, 2005; Ströhle, 2009) should not be ruled out. It is also worth taking note that the IPAQ only measures PA performed in the last seven days, and the positive outcomes of PA on mental well-being were mostly seen in individuals with regular exercise (Chekroud et al., 2018; Ketunen, 2015; Sharma, Madaan, & Petty, 2006).

Strengths and limitations

The current findings offer further insights that the relationship between PA and mental well-being may not be as straight forward. Although the evidence that benefits of PA on mental health is growing over the years, the direction of this association would have to be interpreted with care. Our findings showed that the link between more frequent PA and lower (sub-components of) mental well-being may not necessarily reflect negative outcomes of PA on mental health (e.g., anxiety) but potentially highlighting the engagement of PA (especially the vigorous type) as coping mechanisms. Our study also is the first to show that the relationships between PA and sub-components of mental well-being, with potential coping mechanisms

through PA engagement, varied across young and mid adults. Vigorous PA may be more common in young adults to cope with anxiety but for mid adults, the same level of PA is more likely utilised to cope with low self-acceptance. Future studies should further explore the motives behind PA engagement across age groups and investigate types of PA and its probability as coping mechanisms when dealing with various mental health issues.

One of the limitations of the study was the small sample size. With only a total of 120 respondents, it makes generalisation of the current findings difficult. With a sample of 60 participants in each age group, a power analysis computed using G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that our study achieved approximately 65.4% power when a significant correlation of $r = .30$ was detected. In addition to the sample size, recent studies showed that mental health issues and PA engagement varied across gender (Halliday, Kern, & Turnbull, 2019; Lapa, 2015). In the current study, the young age group was constituted by 75% of females thus making the observed relationship between vigorous PA and anxiety under representative of all gender. Future studies should consistently take gender as a factor when further looking into this relationship. Furthermore, the scales used in the current study were self-reporting scales which could have resulted in self reporting bias. For example, there is a possibility that respondents over-reporting their engagement in PA or under-reporting their current mental well-being. Additionally, reporting PA engagement only in the last seven days cannot warrant if long-term engagement in PA and its association with mental well-being would still exist in a similar direction. Therefore, future studies should replicate these measurements with long-term and short-term PA engagement taken into account.

Conclusion

In conclusion, the main findings of the current study that more frequent vigorous PA is linked to anxiety and self-acceptance may suggest different coping mechanisms across age groups. This provides further insights that engagement in vigorous PA may be treated as a way to adapt to different mental issues or challenges that faced by different stages in life. Future studies need to investigate these links in detail and deeper understand the motivations behind engagement in PA, and how PA can be effectively used as a healthy coping mechanism dealing with different mental issues for different age groups.

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