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Profiles of exercise motivation, physical activity, exercise habit, and academic performance in Malaysian adolescents: A cluster analysis

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ABSTRACT

Objectives: This study examined Malaysian adolescents' profiles of exercise motivation, exercise habit strength, academic performance, and levels of physical activity (PA) using cluster analysis.

Methods: The sample (n = 300) consisted of 65.6% males and 34.4% females with a mean age of 13.40 ± 0.49. Statistical analysis was performed using cluster analysis.

Results: Cluster analysis revealed three distinct cluster groups. Cluster 1 is characterized by a moderate level of PA, relatively high in motivational indices and relative autonomy index (RAI), low in exercise habit, and moderate level of academic achievement. Cluster 2 has superior academic performance but is low in PA and all other measured variables. Cluster 3 is characterized by high levels of PA and all other variables but is lowest in academic performance. One way ANOVA revealed significant differences between cluster groups in total weekly MET, total minutes of weekly PA, academic performance, introjected regulation, and identified regulation.

Conclusion: PA promotion with emphasis on external factors may be effective in instilling exercise habituation among adolescents in the present sample.

Keywords: *Adolescents, Self-Determination, Exercise habit, Academic performance*

Running Head: Exercise motivation

Introduction

The relationships between physical activity (PA) and health-related outcomes are well documented. Indeed, there is evidence that PA provides an array of physical, psychological, social, and emotional benefits for individuals of all ages[1,2, 3]. It has also been suggested that regular PA could positively influence students' academic performance. For instance, Grissom[4] found positive associations between levels of fitness and academic performance among students of grades 5, 7, and 9 covering about 884,715 students in California. Similarly, Trost[5] observed a positive association between regular exercise and academic performance in a review study published between the years 1967 to 2006 involving 58,000 students.

The notion of improved academic performance as a result of PA participation is particularly interesting in the Malaysian

context given the fact that its education system has long been criticized for its examination oriented approach[6]. It has been argued that heavy emphasis on examinations has led to the secondary status of sports and physical activity in Malaysia[7]. If a positive relationship between PA and academic performance can be consistently established, this may be a powerful reason to promote regular sports and PA participation within this population.

However, the relationships between PA and academic performance are not always positive. For instance, in a review of studies from 1984 to 2004, Taras[8] observed a weak relationship between PA and academic performances. The researcher opines that further studies are needed to better understand the PA-academic relationship.

Despite the established benefits of regular PA, increased physical inactivity among adolescents can be observed worldwide [9,10]. Studies conducted among Malaysian children and adolescents have also indicated between low and moderate levels of exercise participation. For instance, Dan, Mohd Nasir, and Zalilah[11] observed that the majority of adolescents in their study had low (35%) and moderate (62%) PA levels. In another study, it was found that 20% of adolescents had total MET (metabolic-equivalent) score below 600[12]. Given the high level of physical inactivity among children and adolescents, understanding their exercise motivation patterns is an important area of research that may be useful in promoting their participation in physical activity [13, 14,15].

In this regard, self-determination theory (SDT) is a useful framework for understanding individual exercise motivation[16]. This theory postulates that behaviour is regulated by different motivational processes, which reside along a continuum of amotivation on one end to intrinsic motivation on the other end. Extrinsic motivation is postulated to exist between these two ends. Amotivation is the lack of motivation to act, while extrinsic motivation exists when a person acts to attain an external outcome. Extrinsic motivation can be further distinguished into external regulation, introjected regulation, and identified regulation. External regulation is characterized by behaviour that is controlled by external rewards or punishments. Introjected regulation refers to behaviour which is controlled by self-imposed pressure, such as avoidance of guilt and shame. Identified regulation involves acting because behaviour is seen as personally important. On the contrary, intrinsic motivation occurs when individuals participate out of inherent pleasure and interest in the activity. A combination of these multiples motivational processes provides a measure of the degree of motivation of an individual and often referred to as self-determination index[17]. This theory further postulates that higher self-determined motivation is likely to lead to positive adaptive outcomes such as increased behavioural engagement. In PA and exercise settings, a higher level of self-determination was found to promote higher PA participation, enhancing self-initiated PA behaviours and consequently promoting well being among adolescents[16, 18].

Another useful framework in understanding PA participation is the theory of planned behaviour (TPB)[19]. According to this theory, attitude, subjective norms, and perceived behavioural control are predictors of behavioural intention, which has been proposed as a strong predictor of actual behaviour[19, 20].Within the TPB framework, habit has been found as an important moderating variable which alters the strength of the intention-behaviour relationship. Specifically, it was reasoned that once the exercise habit is formed, it lessens the

deliberate process of behavioural engagement [21,22].

In summary, understanding specific motivational characteristics of active and inactive adolescents may give insight on how PA promotional strategies may proceed. In an environment where academic achievement is given primary emphasis, establishing a relationship between PA and academic performance may be a powerful way to encourage regular PA participation.

Thus, the primary objective of the present study was to examine the profiles of motivational types, exercise habit, academic performance, and PA levels in Malaysian adolescents using cluster analysis. The second objective of this study was to examine whether there is a meaningful difference between the observed clusters in relation to measured variables. It was hypothesized that high physical activity would be characterized by a higher motivational index, stronger habit, and better academic performance. In contrast, a low PA level would be characterized by low motivational index, exercise habit, and academic performance.

Method

Participants

Secondary school students (N = 300) were randomly selected from three schools in one of the districts in the eastern state in Malaysia. They were aged 13 to 14 years with a mean age of 13.40 ± 0.49. 65.6% of the participants were male, and the percentages of participants aged 13 and 14 were 59.9% and 40.1% respectively. In terms of ethnicity, the majority of the participants were Malay (98%). Participation was voluntary and we obtained informed consents from the participants and their parents or guardians. The number of respondents was determined on the basis 95% confidence interval. With the total number of the target population of 250,000, the minimal required sample size is 380. Out of 380 administered, 80 questionnaires were incomplete and discarded leaving the total number of sample to 300.

Instrumentation

International Physical Activity Questionnaire-Short Form (IPAQ:S-F)

Physical activity was measured using IPAQ:S-F. The validity and reliability of this measure has been extensively established[23]. IPAQ:S-F consists of seven questions about the number of days (frequency) and the number of minutes per day (duration) of participation in all kinds of vigorous, (e.g., heavy lifting, digging, aerobics, or fast bicycling), moderate (e.g., carrying light loads, bicycling at a regular pace, or doubles tennis), and walking PA (e.g., walking at work and at home, walking to travel from place to place, and any other walking for recreation, sport, exercise, or leisure) in the previous seven days.

Although the validity of this questionnaire has been consistently established in the adult population, its reliability and validity in children and adolescents have been less consistent. Despite this inconsistency, our decision to adopt this measure was primarily driven by the brevity required to complete the instrument. Our approach, however, is not unprecedented. There have been recent published studies that used this instrument among children and adolescents[24, 25]. In the present study, we used the adapted version of the questionnaire available on the IPAQ website.

Exercise Habit Strength Questionnaire.

Exercise habit strength was measured using an 18-item Exercise Habit Strength Questionnaire[26]. This measure consists of four subscales (Automaticity, Negative Consequences, Stimulus Cue, and Patterned action) representing the process associated with habitual behaviour. Participants were asked to reflect on their feelings and attitude towards exercise and rated their agreement or disagreement on each statement representing the four habit processes using a six-point Likert scale. Evidence of good internal consistency for the subscales and evidence for criterion-related validity via correlation with objective fitness measures such as Physical Work Capacity (PWC) 170 (r = 0.24) and PWC75% (r = 0.32) has been reported[27]. Subscales' reliability for the present sample were: Patterned Action = 0.60, Automaticity = 0.60, Negative Consequences = 0.78, Stimulus Cues = 0.73.

Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2)

Exercise motivation was measured using BREQ-2. This scale consists of 19 items relating to the five types of behavioural regulation proposed in the SDT[28]. They were External Regulation, Introjected Regulation, Identified Regulation, Intrinsic Motivation, and Amotivation. Each statement reflects the underlying reasons for an individual's decision to engage, or not engage, in physical exercise. Participants were asked to indicate to what extent each of the provided statements was true for them. Responses were indicated on a five-point Likert scale anchored by (0) "not true for me" to (4) "very true for me". The BREQ-2 can be scored by compiling separate subscale scores or computing the Relative Autonomy Index (RAI)[17]. The RAI is a single score that taps the degree to which an individual is more or less self-determined in the regulation of his/her behaviour. Items scores are first multiplied by their specific weights (amotivation = -3, external regulation = -2, introjected regulation = -1, identified regulation = +2, intrinsic regulation = +3) followed by summing these weighted scores. Higher scores represent higher levels of self-determined motivation. Alpha reliability for the present sample were Amotivation = 0.60; External Regulation = 0.66; Introjected Regulation = 0.61; Integrated Regulation = 0.64; and Intrinsic Motivation = 0.78.

Academic Performance

Academic performance was based on the mid-year exam results where each student sat for eight subjects. A single grade point average (GPA) was obtained by averaging these eight subjects. For each subject, students grades were converted to a numerical form ranging from 1 (Grade A) to 6 (Grade F). In this regard a lower GPA represents a better exam performance.

Procedures

Approval to conduct the study was obtained from the university's Human Ethics Committee, Ministry of Education, and the principals of the participating schools. Following approval from the respective authorities, an explanatory letter and information packets were sent to the school to be distributed to the students. Students who were interested in taking part were then given the consent forms, for themselves and their parents or guardians. On a separate day, students who were willing to participate and permitted by their parents were then given the questionnaires to be completed. Questionnaire administration took place in a classroom

setting and was observed by the second and third authors. Students spent an average of 15 minutes completing the questionnaire. Questionnaires administrations were conducted between the midyear and final year examination periods.

Prior to the start of the study, BREQ-2 and Exercise habit strength questionnaire were translated into the Malaysian language by two bilingual speakers with MSc level of academic qualification. The questionnaires were then back-translated into English by another two bilingual speakers. The two versions were compared and where necessary, items refinement was made to ensure the instructions and the items are culturally relevant by the first author.

Statistical Analysis

Cluster analysis was used to create respondents' profile on 10 variables: level of PA (total weekly MET and total minutes of weekly PA), exercise habit strength, intrinsic motivation, external regulation, introjected regulation, identified regulation, amotivation, relative autonomy index, and academic performance. Cluster analysis has recently gained popularity in sport and exercise psychology studies [15]. The advantage of this analysis is that it allows classification of highly similar observations into groups (clusters) with high internal homogeneity and high external heterogeneity. When establishing a psychological profile, this approach may be more meaningful in identifying homogenous groupings than artificially imposing a structure on the observed data. Furthermore, this analysis allows for sample specific variation in the observed profile and thus may be important in understanding cross-cultural differences [15, 29].

The Ward method was used as it minimized the within-cluster differences and avoided problems with forming long, snake-like chains found in other methods, such as the single-linkage procedure[30]. Prior to the analysis, the data were transformed into z-scores in order to standardize the scale. This is necessary given the variability in the response scales of the measures. One-way ANOVA was then used to examine differences in the dependent variables among the observed clusters. Both cluster analysis and ANOVA were computed using Statistical Package for Social Science (SPSS) version 18.

Prior to the main analyses, confirmatory factor analysis (CFA) was performed using Analysis of Moment Structures (AMOS v.18) software to evaluate the factorial validity of BREQ-2 and exercise habit strength questionnaire for the present sample. The selected model fit indices were the chi-square statistic (χ^2), the χ^2/df ratio, the goodness of fit index (GFI)[31, 32], and the root mean square error of approximation (RMSEA)[32]. A good model fit is indicated values less than 3.0 for χ^2/df ratio and values of 0.90 or higher for the GFI. For the RMSEA, values of 0.05 or lower indicate close fit, while values less than 0.08 indicate acceptable fit. Finally, Cronbach's alpha was used to assess the internal consistency of the scale.

Results

Scores from the primary measures were computed and were examined for outliers and distributional properties. Missing values were minimal and a mean substitution was used. Multivariate outliers were detected using Mahalanobis distance. At a .001 cut-off point, eight outliers were present and removed from the analysis. Inspection of the skewness and kurtosis indices revealed some departures

from normality. However, no variable transformations were deemed necessary. The full-sample descriptive statistics and intercorrelational scores between the measured variables are presented in Table 1.

In relation to the BRE-Q, the CFA results indicated acceptable factorial validity and reliability of the measure. Specifically, CFA revealed adequate fit ($\chi^2 = 262.16$, df = 142, $p < 0.001$, $\chi^2/df = 1.85$; GFI = 0.91; RMSEA = 0.05). Furthermore, significant nonstandardized factor loadings were obtained for all items. Standardized factor loadings ranging from 0.36 to 0.79 were also obtained. Moreover, our analysis also revealed acceptable alpha coefficients for each of the subscales: Amotivation = 0.60; External Regulation = 0.66; Introjected Regulation = 0.61; Integrated Regulation = 0.64; and Intrinsic Motivation = 0.78.

Evidence of factorial validity and reliability was also obtained for the exercise habit measure. More specifically, CFA revealed adequate goodness of fit ($\chi^2 = 222.76$, df = 129, $p < 0.001$, $\chi^2/df = 1.72$; GFI = 0.92; RMSEA = 0.05). Significant standardized factor loadings and standardized factor loadings ranging from 0.23 to 0.72 were also obtained for all items. In addition, the results also revealed acceptable alpha coefficients for each of the subscales: Patterned Action = 0.60, Automaticity = 0.60, Negative Consequences = 0.78, Stimulus Cues = 0.73.

Results of cluster analysis revealed a three-cluster solution for the present data (Table 2). For labelling purposes, a median split was used to categorize the variables into high and low categories. For PA classification, a total MET min/week of < 600 indicates low activity, MET min/week of 600 – 2999 indicates moderate activity, and MET min/week of >3000 indicates high activity. The three clusters were labelled (1) Moderate activity – Low RAI – Low exercise habit, (2) Low Activity – Low RAI – Low exercise habit and (3) High activity – High RAI – High exercise habit. There were 143 students in Cluster 1, 88 students in Cluster 2, and 61 students in Cluster 3.

Cluster 1 is characterized by a moderate level of physical activity, relatively high in motivational indices and RAI, low exercise habit, and a moderate level of academic achievement. Cluster 2 has superior academic performance but is low in physical activity and all other measured variables. Cluster 3 is characterized by a high level of physical activity and all other variables. Interestingly, they were characterized by the lowest level of academic achievement.

One-way ANOVA was then performed for each of the variables and significant differences were found between cluster groups in total weekly MET, total minutes of PA, academic performance, introjected regulation, and identified regulation. Post hoc analyses were performed for these variables and are presented in Table 3.

Discussion

This study aimed to profile students on the basis of their physical activity levels, exercise habit strength, relative autonomy index, academic performance, and five types of behavioural regulation. Cluster analysis revealed three distinct clusters of high, moderate, and low physical activity.

Physical inactivity among children and adolescents has becoming a global issue and Malaysia is no exception. In fact, previous studies revealed only low to moderate levels of regular exercise among Malaysian adolescents[11]. The present findings add to this literature by confirming that only 20% of adolescents in the present sample had high PA

levels. The majority of the participants had moderate (50%) and low levels (30%) of physical activity.

Our results suggest that high and low activity cluster groups exhibited motivational profiles in the expected directions. Specifically, the high activity group exhibited higher motivational levels, a marked contrast to those of the low activity group, especially in introjected and identified regulations. It is clear from these findings that the PA level among high activity adolescents in the present sample is largely driven by external factors. Although the specific external reasons for participation were not assessed in the present study**,** Gillison et al.[33] found that in British boys, regulation was largely related to social factors, such as avoiding social disapproval and attaining ego enhancement. On the other hand, they also found that introjected regulation in girls are largely due to the partial internalization of a health and fitness rationale. Moreover, the present findings also suggest that PA regulation among Malaysians was influenced by, to some degree, the inherent interest in the activity. This is evident from a significantly higher identified regulation among the high activity group than the low activity group.

Intrinsic interest in PA among the high activity group is also reflected in their relatively stronger exercise habit, when compared to both the moderate and low activity cluster groups. It has been argued that habit formation reflects four processes: (a) strong stimulus-response bonds, (b) automaticity, (c) negative consequences if they are not executed, and (d) predictable patterns of engagement[34]. It is our view that these processes may be translated into practical implementation in order to promote exercise habituation.

Behavioural automaticity may be promoted through frequent repetition of the target behaviour[35]. In terms of exercise, providing opportunities to participate may be translated into frequent participation. In turn, this may foster exercise habituation. However, getting adolescents to regularly exercise is the fundamental issue in PA and exercise promotion. A potentially effective strategy is to remove barriers associated with PA and exercise.

For instance, among adolescents, it was found that the key barriers to PA engagement included lack of peer social support, and low access to and availability of physical activity opportunities[36]. Removing and/or minimizing these barriers may be beneficial in promoting PA and exercise among adolescents.

Second, since habit is associated with strong stimulus-response bonds, it may be useful to design intervention that exposes adolescent to exercise cues and prompts[37]. The effectiveness of exposure to behavioural cues can be seen in a longitudinal study of the usage of stairs and elevators. It was found that cues to use stairs over elevators elicited greater usage of stairs. In fact, when the cues were removed, behavioural persistence was still observed[37].

It was noted that the high activity group exhibited relatively low academic performance. Although it has received little scientific attention, there is a widespread belief among Malaysian educators that active involvement in sport is the reason that students underachieve. For instance, in a study among 300 educators on boys' underachievement in exams, educators believe that academic achievement requires undivided attention to exam preparation[38]. One of the respondent remarked, "It's an exam-oriented system and mugging of facts; girls like to work hard handling homework; they accommodate well with the exams". In turn, active involvement in sports and physical activity are believed to take away study hours. One of the respondents remarked that

underachievement in boys was because "Boys like to shine in sports and games"[38]. Without doubt, this notion awaits further empirical studies to identify the nature of this belief and strategies to overcome this negative belief regarding active involvement in sports and PA.

In summary, the present study reinforces the roles of self-determination in understanding exercise behaviours[18]. Adolescents' engagement in PA in the present study was largely driven by external factors. It may be beneficial for future studies to assess specific reasons for exercise. The present study also highlighted the differences in exercise habit strength among high, moderate, and low activity groups. Thus, strategies to promote exercise habituation may be useful in ensuring student internalization of PA. In this regard, we view that removing exercise barriers and exposing adolescents to exercise may be an effective strategy in promoting exercise habituation. Finally, our findings revealed that the high activity group was characterized by relatively low academic performance. While this finding is counter inference, it indicates a critical need to change the perception towards sports and physical activity in the present sample.

While we believe these findings have considerable practical value, we must, of course, acknowledge the potential limitations surrounding our research. Firstly, as in other self-reported measures, these measures may be influenced by recall errors and social desirability biases. Secondly, the sample was limited to students aged 13 and 14, thereby restricting the ability to generalize the findings beyond this age range. Finally, the response rate was not considered in sample size calculation, thus, it may affect the study power. We encourage our colleagues to pursue similar studies using objective PA measures in addition to the self-reporting measures used here. We also encourage future studies to address other age groups in order to determine if our findings are age-specific or more general.

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Table 1: Descriptive statistics and intercorrelations between the primary variables

		Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Total MET	2400.08	1363.25	1	.95**	0.09	0.09	0.06	0.09	0.03	0.21**	0.21**	0.11
2	Total Minutes of PA	420.61	219.71		1	0.02	0.06	0.04	0.07	-0.01	0.17**	0.17**	0.06
3	Academic Performance	3.15	1.16			1	0.02	-0.31**	0.35**	0.40**	0.22**	0.05	-0.04
4	Exercise Habit Strength	36.78	14.40				1	0.24**	0.12*	0.23**	0.48**	0.51**	0.44**
5	Relative Autonomy Index	27.57	22.17					1	-0.62**	-0.40**	0.04	0.53**	0.74**
6	Amotivation	3.35	3.26						1	0.40**	0.22**	0.09	-0.10
7	External Regulation	3.55	3.46							1	0.41**	0.21**	0.12*
8	Introjected Regulation	3.29	2.93								1	0.55**	0.35**
9	Identified Regulation	7.90	3.83									1	0.63**
10	Intrinsic Motivation	10.74	4.21										1

** Correlation is significant at the 0.01 level (two-tailed)
* Correlation is significant at the 0.05 level (two-tailed)

Table 2: Descriptive statistics of primary variables for specific cluster groups

		Cluster 1 Moderate Activity – Low RAI – Low Habit (N = 143)	Cluster 2 Low Activity – Low RAI – Low Habit (N = 88)	Cluster 3 High Activity – High RAI – High Habit (N = 61)
Total MET*	Mean	2446.23	887.40	4474.12
	SD	569.00	332.43	593.77
Total Minutes of PA*	Mean	443.36	172.00	725.94
	SD	113.32	65.17	104.42
Academic Performance*	Mean	3.05	3.07	3.50
	SD	1.21	1.062	1.12
Exercise Habit Strength	Mean	37.10	34.98	38.64
	SD	15.37	14.17	12.13
Relative Autonomy Index	Mean	27.62	25.81	29.97
	SD	21.78	22.13	23.22
Amotivation	Mean	3.31	3.10	3.83
	SD	3.31	3.23	3.22
External Regulation	Mean	3.74	3.19	3.61
	SD	3.66	3.28	3.23
Introjected Regulation*	Mean	3.69	2.39	3.65
	SD	3.10	2.50	2.86
Identified Regulation*	Mean	8.13	6.78	8.98
	SD	3.91	3.78	3.31
Intrinsic Motivation	Mean	10.80	10.17	11.43
	SD	4.16	4.46	3.89

Note: Asterisk (*) denotes significant one-way ANOVA at 0.05

RAI = Relative Autonomy Index

Table 3: Multiple comparisons between the three cluster groups

Dependent Variables	Pairwise comparison between cluster groups		Mean Difference	Std. Error	Sig.
Academic Achievement	1	2	-0.014	0.16	1.00
	1	3	-0.44*	0.18	0.036
	2	3	-0.43	0.19	0.077
Total MET min/week	1	2	1558.82	69.82	0.000
	1	3	-2027.90	78.80	0.000
	2	3	-3586.72	85.85	0.000
Total minutes of PA	1	2	271.38	13.45	0.000
	1	3	-282.57	15.20	0.000
	2	3	-553.95	16.54	0.000
Introjected Regulation	1	2	1.29	0.39	.003
	1	3	0.04	0.44	1.000
	2	3	-1.26	0.48	0.027
Identified Regulation	1	2	1.35	0.51	0.026
	1	3	-0.86	0.57	0.41
	2	3	-2.20	0.63	0.001

Note: Cluster labels: (1) Moderate activity – Low RAI – Low exercise habit, (2) Low Activity – Low RAI – Low exercise habit and (3) High activity – High RAI – High exercise habit