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Impact of Aerobic Exercise on Cognitive Function: A Study of Knowledge and Awareness among Physiotherapy Students

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Abstract

Aerobic exercise is structured, repetitive, and purposeful, aiming to improve physical fitness and enhance cognitive performance, which includes processes like language, perception, attention, memory, and decision-making The aim of this study was to provide a detailed understanding and awareness of the effects of aerobic brain exercise among physiotherapy students. Quantitative Cross – sectional study, self – administered questionnaire design. Ethical approval was obtained. All Malaysian physiotherapy students were selected at random. Google Form was used to create the questionnaire, which included closed-ended questions. Using IBM SPSS statistics version 22.0, frequency analysis was carried out. Among physiotherapy students, 83.9% (n=302) knew that aerobic exercise (AE) improves cognitive function, while 16.1% (n=58) did not. 46.4% identified the recommended 150 minutes of moderate-intensity AE per week. 27.5% strongly agreed AE raises academic standards, 41.7% agreed it protects thinking and memory, and 48.7% said it improves focus. 44% believed AE enhances learning and attention, while 30.8% thought it produces new brain cells. 37.7% agreed AE improves verbal and memory skills, and 55.6% strongly agreed AE enhances motor function. The current study revealed that majority of the physiotherapy students reported being aware of the AE on CF. However, half of the physiotherapy students does not have the knowledge that regular AE improves CF.

Keyword: *Aerobic Exercise, Awareness, Cognitive Functions, Health Risks, Knowledge, Public Health, Education Quality.*

Introduction

Aerobic exercise (AE) involves skeletal muscle movements that expend energy, promoting health and psychological well-being [1]. AE has been defined by the American College of Sports Medicine as rhythmic activities using large muscle groups, AE uses fatty acids, carbohydrates, and amino acids to generate energy through aerobic metabolism [2]. Activities that are advised to maximize aerobic capacity include cycling, dancing, hiking, jogging, running, swimming, and walking [3]. Studies indicate that AE improves cognitive performance, which may help promote balanced aging [4, 5].

Aerobic fitness benefits brain health by improving cerebral blood flow and removing waste, while also boosting Brain-Derived Neurotrophic Factor (BDNF) and insulin-like growth factor (IGF), critical for vascular health, blood circulation, and brain cell growth [6-9].

Higher brain functions are permanently altered by aerobic exercise, which also promotes gains in mental health, IQ, and cognitive skills like memory and concentration

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as well as the ability to develop more useful coping strategies for stressful circumstances [10, 11].

Cognitive function (CF), encompassing perception, focus, memory, decision-making, and language comprehension, develops across the lifespan from infancy to adulthood, with semantic memory peaking later in life [12-14]. Declines in CF can hinder daily activities (ADLs) in older adults. Interventions enhancing CF draw interest across age groups, crucial for adaptive behaviors, mental growth, and academic performance [15-17]. Since academic performance is a major contributor to success, it is one of the most significant factors affecting a student's life [18, 19].

The brain's capacity to respond to experiences remains intact throughout life [20, 21]. AE enhances neuroplasticity and cognitive function, especially when combined with cognitive tasks, highlighting the efficacy of dual-task training [22-24].

The studies aim to elucidate AE's impact on brain function, connecting human research findings and assessing awareness among physiotherapy students regarding AE's cognitive benefits.

Materials and Method

A self-administered questionnaire was used to perform this quantitative cross-sectional investigation. In order to conduct this study, Google Forms was used for the online questionnaire self-reporting of all institutes' physiotherapy students. The researcher created the questionnaire that was used to evaluate students' awareness and knowledge of cognitive function during aerobic activity. The questions on the questionnaire have been carefully crafted to ensure that they are pertinent and precise in relation to the information needed to provide an answer. Survey respondents were asked to indicate whether or not they were aware of the advantages of aerobic exercise for cognitive function. If they were, they were asked to respond to additional questions about knowledge and awareness in the following section. A self-administered questionnaire with closed-ended questions, such as Likert scale questions, was used to collect data. The above is also assured in order to resolve the problems related to validity, reliability and to increase the consistency of the participants' knowledge of the questionnaires. The creation of the content of the questions was focused based primarily on personal experience and a study of prior literature to provide physiotherapy students with larger areas of research on knowledge and awareness of the effects of aerobic exercise that are likely to improve cognitive functions.

The questionnaire were constructed in five sections as follows:

Section 1 was related to demographic details. It consisted age, gender, education level, year of study and semester, located at the beginning of the questionnaire.

Section 2 consisted of five elements (participation, benefits, risk, confidential, and consent) in the form of ethical. Basically, this segment is when participants understand the topic of the study project and tick whether participants understand. Whereas (three statements) would be stated at the end of the section if they have confirmed, read, understand, and voluntarily participant the research project. The option were: "Tick if you understand".

Section 3 consisted of five questions, four concerning the participants' lifestyle and the fifth about their awareness of how aerobic activity affects their cognitive function before moving on to the next section. The options for answering were: (1) yes and (2) no. All respondents who answered 'yes' will proceed directly to Section 5 to respond the 'Knowledge and Awareness" section, while the 'no' response will proceed to Section 4.

In Section 4, the advantages of aerobic exercise on cognitive function were briefly discussed. Those participants who are not

aware the advantages of cognitive aerobic exercise and answered to 'no', the section 3 will be specifically direct to this particular section, after that the study will eventually be terminated.

Section 5 consisted of twelve items combining one optional questions and rating scale type of questions in exploring the students' knowledge and awareness of aerobic exercise on cognitive performance. A rating scale type of question was constructed in this questionnaire when exploring the concept or aspects related to agree/disagree. In this study, the perceptions of the level of agreement/disagreement linked to the knowledge and awareness of aerobic exercise on cognitions was a 5- point scale ranging 1 to 5 (strongly disagree to strongly agree. The format consisted of questions mainly closed-ended. 364 responders in all were found at the end of the day, out of the 341 physiotherapy students who were targeted. Based on the target population's experiences as physiotherapy students, random sample was chosen for this study. Based on the inclusion and exclusion criteria, the subjects have been chosen. Eligibility requirements: Any gender, age restriction, diploma or degree, focused on physiotherapy students from Malaysian universities and colleges in their first to last semester. Students who complete a diploma or degree program in physiotherapy but discontinue their studies midway are excluded. The questionnaire was carried out from the 24th of October 2020 till 7th November 2020. This questionnaire require less than 5 minutes to complete.

Confidentiality and anonymity have been highlighted in the information sheet. The participant's consent/agreement was presumed if the questionnaire was completed. The survey was opened for a period time of 15 days but there was fewer responses after 7 days. In order to resolve the low response issue, a reminder was sent out to all participants as an advanced reminder to enable participants to respond the survey. On the 14th day before the second reminder was to be submitted to the social media, the questionnaire was found more responses than planned and so no second reminder was required. On the 15th day, 12 a.m. the survey was closed and students were unable to participate after the particular date.

On the basis of the National Research Ethic Service (2004), all research concerning human beings needs ethical concern to guarantee their protection, confidentiality and integrity. The research request for this study was sent to Ethics Committee for approval by Research Ethics Committee of INTI International University. Ethic approval ID: INTI-IU/FHLS-RC/BPHTI/1NY12020/003. Informed consent was sought before data collection to ensure the involvement of participants on voluntary basis. IBM SPSS statistics version 22.0 for Windows was used to analyze the data. Frequencies, averages, standard deviations, and 95% confidence intervals are examples of descriptive statistics that indicate there is only 5% (margin error) chances of simple result differing by using EPI info software. Descriptive analysis of the demographic data of the respondents was done for example gender, education level, semester and lifestyles displayed in Table 1. Secondly, all data obtained from the questionnaire is processed by means of coding. Finally, the finding of the study were summarised and documented in the following chapter. A clear, non-repetitive, written analysis explaining the relevance of the finding clearly represented.

Table 1. Demographic Characteristic of Study and Lifestyle Factor:

Variable	Sub category	Number (n)	Percentage (%)
Gender	Female	256	71.1
	Male	104	28.9

Education level	Diploma	62	17.2
	Degree	298	82.8
Year of study	1	75	20.8
	2	74	20.6
	3	123	34.2
	4	88	24.4
Semester	1	38	10.6
	2	39	10.8
	3	38	10.6
	4	38	10.6
	5	53	14.7
	6	70	19.4
	7	68	18.9
	8	16	4.4
Lifestyle	Active	229	63.6
	Sedentary	131	36.4
Exercise regularly	Yes	191	53.1
	No	169	46.9
Exercise per week	< 1 hours	112	31.1
	1-2 hours	105	29.2
	3-4 hours	50	13.9
	4-5 hours	20	5.6
	>5 hours	33	9.2
	None	40	11.1
Exercise Preference	Weight training	53	14.7
	Cardio training	195	54.2
	Weight and Cardio training	71	19.7
	None	20	5.6
	I don't know	21	5.8

Result

After the initial questionnaire was sent, 113 (33.7 %) response were received within 1 week. Thus a reminder was sent again, leading to a response rate of 314 (92.1 %) while at the end of 15th day the response rate was 364 (106.7%) for the study. The Statistic Programme for the Social Sciences (SPSS) software version 20.0 was used to analyze the quantitative data gathered from the demographic information part of the questionnaire. Therefore, the main findings from closed-questions are displayed by frequency and descriptive analysis, which is based on bar charts and pie charts formats.

Closed-question of Knowledge and Awareness:

A total number of 360 participants from the study were volunteered, 302 of them were aware on benefits of AE by giving a response rate at 83.9%, whereas 58 (16.1%) of them were terminated from the study. (Figure 1).

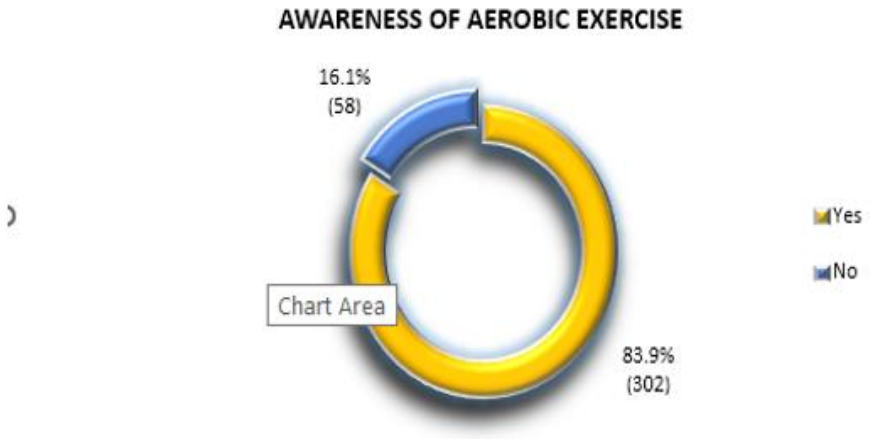

Figure 1. Total Number of Students Aware on AE, Cognitive and the Benefits

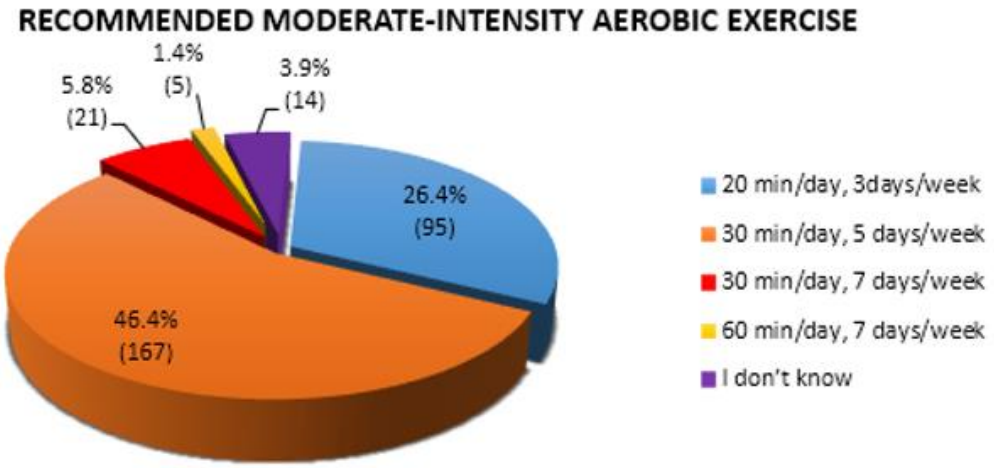

Figure 2. Recommended of Minimum Amount of Moderate-Intensity AE per Week Based on Recommendation

Figure 2 shows that, the largest proportion of respondents correctly identified the recommended moderate-intensity needs at least 150 minutes AE per week is 46.4%. Therefore, 26.4% said 20 min/day, 3 days/week, followed by 5.8% said 30 min/day,7 days/week, 1.4% for 60 min/day, 7 days/week, and 3.9% were not sure.

The majority of respondents—46.7% strongly agreeing and 40.7% agreeing—strongly agreed that regular AE improves cognitive function in relation to their awareness of issues regarding AE. But 1.7% strongly disagreed and 10.9% disagreed. Thirty-five percent agreed, twenty-seven percent strongly agreed, and thirty-eight percent were neutral to the idea that AE raises academic standards. In contrast, 1% strongly disagreed and 8.3% disagreed.

The percentage of respondents who believed that regular AE does not raise the risk of acquiring anxiety and depression during the following five years was just 1.3% (n=4) and 4.6% (n=14). Regular AE lowers this risk, according to the majority of responders (47.7%), of whom 31.1% strongly agreed. 18.2% of the population remained neutral. The majority of respondents, 46.4%, agreed and 38.1% strongly agreed that regular art therapy (AE) aids in overcoming impairments in emotion regulation. Still, 11.9% ere neutral, 0.7% disagreed, and 3% strongly disagreed.

With 41.7% agreeing and 36.4% strongly agreeing, the majority of respondents believed that regular AE preserves or enhances working memory and accessible recall, safeguarding memory and cognitive abilities. 4.6% disagreed, while 17.2% expressed no opinion.

Furthermore, 48.7% of respondents agreed and 38.7% strongly agreed that AE improves attention and focus, whilst 10.3% were indifferent and 2.3% disagreed. The majority of respondents (44%), with 43.4% strongly agreeing, felt that regular AE enhances learning and controls attentiveness. But 1.7% disagreed and 10.9% were neutral. Comparably, 44% agreed and 42.7% strongly agreed that AE speeds up reaction times, whilst 1.3% disagreed and 11.3% were undecided.

30.8% of respondents agreed, 30.5% strongly agreed, 30.1% were neutral, 6.3% opposed, and 2.3% strongly disagreed with the idea of creating new brain cells. Most participants concurred that consistent AE enhances verbal memory, with 37.7% agreeing and 30.8% strongly agreeing. However, 25.2% were neutral, 5.3% disagreed, and 1% strongly disagreed. Finally, while 37.1% of respondents agreed, 55.6% of respondents strongly felt that regular AE enhances motor performance. On the other hand, 0.7% disagreed, 0.3% strongly disagreed, and 6.3% were neutral.

Discussion

The results highlight important issues related to AE's effectiveness on CF and its awareness among physiotherapy students. Personal experiences, recent data should be applied to interpret AE and CF, as relying solely on personal experience leads to inadequate knowledge [25].

To systematically analyze AE's impact on cognitive function among Malaysian physiotherapy students, this study developed a questionnaire, revealing a lack of current literature on this topic, despite most participants acknowledging AE's benefits. Despite 83.9% awareness of AE's benefits, only 46.4% correctly identified recommended AE levels. The study found that active students had higher life satisfaction. However, a nearly equal number of students exercised regularly and did not, indicating a lack of awareness about routine physical exams. Most students preferred cardio training (54.2%) over weight training.

Regular AE was found to benefit cognitive function, with 83.9% of students recognizing its advantages for various age groups. Additionally, 75.8% agreed that AE does not increase the risk of depression and anxiety. Regular AE also aids in emotion regulation (85.5%), working memory, and cognitive flexibility (78.1%). Despite the benefits, 87.4% of students agreed AE enhances cognitive function for adults with neurologic disorders. However, only a few studies focus on AE's effect on emotion regulation and cognitive flexibility [26].

Moderate-intensity AE helps improve mood, memory, and sleep. This aligns with findings that AE benefits cognitive function, with 87.4% agreeing on its positive impact. AE also improves reaction time and concentration (86.7%). It boosts brain health by increasing blood flow and supporting hormone release, which aids brain cell growth [27]. AE significantly improves verbal recall and learning, with 68.5% of students acknowledging this. The majority agreed on AE's positive impact on cognitive function and motor memory formation.

To enhance knowledge and awareness of AE, various methods, including social marketing, should be used. Professional AE benefits both personal wellbeing and career satisfaction.

The strengths of the current study are a globally representative study population targeted to physiotherapy students in Malaysia. In addition, this is the first study to examine the knowledge and awareness of aerobic exercise on cognitive function, to be best of our knowledge. Findings are generalised, the collection procedure is well-designed and sample is representative and sufficiently straightforward to interpret for the research population. The data is clear, correct and reliable. As noted, self-administered

questionnaire were used in the current study to examine the proportion of individuals with knowledge and awareness.

The Limitation of the study are A self-administered questionnaire was choose by the data collection tool in this study. In this report, there was no comparative study conducted. The only limitation is that respondents with their responses may not be 100% honest or unconfused. Despite these limitation, the current study include updates on the knowledge and awareness of aerobic exercise on cognitive function by students of physiotherapy. Further study should be done to know more about the knowledge and awareness about aerobic exercise in the general population. A comparative analysis of the perceptions of these study among Malaysian Physiotherapist could be performed. This would give greater depth in comparison of perceptions.

Conclusion

In conclusion, the current study revealed that 83.9% of the physiotherapy students reported being aware of the AE on CF. However, half of the physiotherapy students does not have the knowledge of the enhancing cognitive function by performing regular aerobic exercise. Therefore, majority of the reported neutral. These results suggested need to use various methods to increase or raise knowledge among physiotherapy students of the AE on CF.

Conflict of Interest

Nil.

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