RESEARCH ARTICLE

Widening Health Research Initiatives for Older Adults in Malaysia: A Scoping Review of Exercise-Related Physical Activity

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Abstract: Increasing health concerns among the older adult population in Malaysia may be ameliorated by the use of physical activity/exercise. To aid in this endeavor from an academic perspective, a scoping review was undertaken to map out the extant literature, identify research gaps, and provide directions for future research on the subject of older adults, physical activity/exercise, and health. The PRISMA-ScR guidelines were followed, and major academic databases were searched for relevant academic literature. From an initial 42,752 database search results, a total of 15 articles were finalized for data extraction, analysis, and synthesis after four rounds of exclusion. Gaps identified include methodological, geographical, and utilization of information technology deficiencies, as well as a lack of longitudinal studies, focus on one specific disease, limitation of ethnicity, lack of customization of exercise programs, and limited types of physical activity or exercise in the present studies. Suggested directions for future research ideas include qualitative research, longitudinal research, use of media and IT for health information dissemination, the inclusion of population segments older than 60 years of age, research focused on diseases other than diabetes, widening research to include socio-demographics such as ethnicity/gender/education/ employment and physical activity and exercise, customization of physical activity and exercise programs, and expansion of the types of physical activity and exercise used by. Further research in these areas would assist relevant stakeholders to prepare for the growing aging population in Malaysia.

Keywords: Malaysia, older adult, physical activity, exercise, health.

Studies in Malaysia indicate a rise in the number of older adults who are diagnosed with various health issues, including diabetes, hypertension, and hypercholesterolemia (Ariaratnam et al., 2020; NoorAni et al., 2018). Furthermore, the academic contributions of Ab Majid et al. (2020), Baharudin@ Shaharuddin et al. (2020), Chan, Sooryanarayana, et al. (2019), Chan, Lim, et al. (2020), and Sazlina et al. (2020) added not only to the growing evidence that this segment of the Malaysian population faces a growing concern with various health issues (i.e., diabetes, hypertension, hypercholesterolemia, dementia, and cardiovascular disease) but more importantly, a lack of physical activity/exercise (PAE) contributes to the exacerbation of these health issues. Studies in other parts of the world have shown that PAE has both physical health and mental health benefits for older adults (Chen, He, et al., 2021; Chen, Song, et al., 2021; Cho & Kim, 2020; Di Lorito et al., 2021; Dean et al., 2021; dos Reis Caldas et al., 2021; Gour et al. 2020;

Hayashi et al., 2021; Liang et al., 2021; Rezaeipour, 2021; Ribeiro et al., 2021; Widjaja et al., 2021; Wu et al., 2021). PAE is, therefore, a necessary weapon in the Malaysian arsenal to combat health issues in the aging population in the country (Iddrisu et al., 2020).

One means of sharpening the use of PAE to mitigate rising health issues and increase health levels among the elderly in Malaysia is through an assessment of the present state of the extant academic literature to identify gaps in the research and future directions for research. Such an academic endeavor can be operationalized via a scoping review (Tricco et al., 2018; Arksey & O'Malley, 2005; Levac et al., 2010; Munn et al., 2018). Therefore, the aim of this scoping review is to address the research that has been conducted in Malaysia that is in relation to PAE and older adults aged 60 and above with the ultimate aim of providing members of the academic community with potentially new avenues of research that would enhance the use of PAE in mitigating health issues as well as preserving and maintaining health among this segment of the population in Malaysia.

Rationale and Objectives

A preliminary and cursory search in various databases indicates a scoping review on this subject in Malaysia has yet to be conducted, although there is evidence that this segment of the population in Malaysia is growing in number, is facing increasing health issues related to aging, and PAE is a means of mitigating these health issues (Ariaratnam et al., 2020; NoorAni et al., 2018; Ab Majid et al., 2020; Baharudin@Shaharuddin et al., 2020; Chan, Sooryanarayana, et al., 2019; Chan, Lim, et al., 2020; Sazlina et al., 2020). These cited scholarly works indicate that PAE is recognized as a tool for health management among older adults, but the extent, results, and outcomes of PAE have not been looked at holistically in Malaysia. Additionally, the presence of such research and their findings indicate that a scoping review on PAE, health, and older adults aged 60 years and above is timely, would address a gap in the extant literature, and potentially act as an impetus for future research on the subject. Therefore, the rationale of this scoping review is based on the question, "What may be learned from the present extant literature in terms of PAE, health, and older adults aged 60 and above in Malaysia?" The information gleaned from this scoping review would be instrumental in providing directions for future research in the use of PAE to intervene in health issues, as well as to maintain and preserve health among the elderly.

Scope of the Review and Definitions

This scoping review focuses on the PAE and health of older adults aged 60 and above in Malaysia. These form the population, concept, and context (PCC) of this research: (a) Malaysians aged 60 years and above being the population (P); (b) PAE being the concept (C); and (c) health (physical and mental) being the context (C). The author is cognizant that a working definition for old age set in conjunction with the World Health Organization (WHO) by Kowal et al. (2001) is the age of 50 in a developing nation. The age range between 60 and 65 is an acceptable construct for determining old age in a developed nation. Additionally, the author is also cognizant that, based on the work of Orimo et al. (2006), persons at the median age of 65 still have acceptable health functions, and therefore, older adults should be classified as those above the age of 75 (the age where health decline is most common). However, the government of Malaysia deems a person an older adult at the age of 60 (www. malaysia.gov.my); therefore, this is the age that will be used to determine the eligibility of the literature for inclusion in this scoping review. In terms of physical activity, the author has differentiated physical activity (activities connected to physical exercise) from leisure activities (activities that are social or that are focused on rest and relaxation done in the free or spare time without obligation or duty) and focuses on the former (Minhat & Amin, 2012). This scoping review focuses on academic articles published between January 1st, 1990 and June 2023 so that a comprehensive body of the academic literature on the subject being studied can be derived.

Method

Protocol, Registration, and Eligibility Criteria

Ethical approval was obtained prior to beginning this research, and no human subjects were used. The methodology adopted by this scoping review is the PRISMA-ScR by Tricco et al. (2018), and no review protocol for this scoping review was registered with PROSPERO as per that organization's regulations; however, the protocol for this scoping review was established prior to the execution of the review. The

literature is limited to the academic literature published in academic journals where Malaysia is the geographic parameter of the research; the timeframe of the publication of the articles was between January 1990 and June 2023 to have the relevant literature of the past 31 years. The start year of 1990 is chosen as it is the year when the population of Malaysia, including the aging population, was expected to rise exponentially (Mafauzy, 2000). The languages of publication are English and Bahasa Malaysia, as the former is the language of international publications and the latter is the national language of Malaysia. The aim of using both these languages was to ensure that no potentially relevant articles were excluded. Additionally, the author is proficient in both languages, and this assists in the database searches. Empirical and research studies were included in this scoping review. Grey literature were excluded.

Information Sources

The scoping review sought information sources from the ASEAN Citation Index (ACI), BioMed Central (BMC), Directory of Open Access Journals (DOAJ), Embase, JSTOR, Nursing and Allied Health Database, PubMed, SAGE Journals Online, ScienceDirect, SpringerLink, Taylor & Francis, Web of Science, and Wiley Online Library databases. Both social sciences and medical databases were included in the database searches due to the exploratory nature

of the scoping review as well as to ensure that the database searches are comprehensive. The date of the most recent search on all databases was June 15, 2023.

Search Strategy

The English keywords used for searching the relevant literature were selected to meet the research focus of the scoping review, namely: Malaysia, the elderly, older adults, senior citizens, the aged, exercise, physical activity, and health. The Bahasa Malaysia keywords used were the translations of the English Language keywords: Malaysia, *orang tua* (the elderly), *warga emas* (senior citizens), *senaman* (exercise), *aktiviti fizikal* (physical activity), and *kesihatan* (health). Boolean operators were used with these keywords in all the database searches. Table 1 illustrates the search strategy used for this scoping review.

Selection of Sources of Evidence

The process of selecting the sources of evidence was based on four rounds of exclusion. The first round of exclusion removed articles for lack of fit with the scoping review based on the geographic setting of the research as well as the population of focus in the article. The second round of exclusion excluded duplicate articles. The third round of exclusion excluded articles based on the assessment of the titles and abstracts of the articles. The author conducted the assessment of the title and article simultaneously so as not to exclude titles and abstracts that were a potentially good fit for

Table 1

Search Strategy

Database	ASEAN Citation Index (ACI), BioMed Central (BMC), Directory of Open Access Journals (DOAJ), Embase, JSTOR, Nursing and Allied Health Database, PubMed, SAGE Journals Online, ScienceDirect, SpringerLink, Taylor & Francis, Web of Science and Wiley Online Library.
Other sources	None
Key searched terms	<Malaysia>, <the elderly>, <older adults>, <senior citizens>, <the aged>, <exercise>, <physical activity>, <health>, <orang tua>, <warga emas>, <senaman>, <aktiviti fizikal>, <kesihatan>.
Language	English Language and Bahasa Malaysia
Location	Malaysia
Duration	1st January 1990 – 15th June 2023
Types of study	Empirical studies
Type of publication	Research articles
Exclusion criteria	Editorial, opinion pieces, conference proceedings, letter to the editor.

the focus of the scoping review but did not necessarily reflect this in the title. The fourth round of exclusion excluded articles based on the full text assessment of the articles, that is, the entire article was read and the contents were assessed for match and suitability with the focus of the scoping review.

Data Charting Process

The finalized articles were read, and the author extracted the relevant data. All relevant extracted data were placed into a charting table with criteria determined by the focus of the scoping review. A further explanation of the data charting process is explained in the section on synthesis of the results.

Synthesis of Results

Relevant data from the finalized articles were summarized in the charting table. All repetitive data and inconsistencies were rectified, and summarized data were checked for accuracy and relevance. Data were then summarized and synthesized.

Results

Selection of Sources of Evidence

A stringent search in the aforementioned databases produced a total of 42,752 potential articles for this scoping review. From these 42,752 articles, 85 articles were identified based on the geographic setting and population of the article for possible fit with the scoping review as the first round of exclusion. The second round of exclusion based on duplication of articles removed 39 articles, leaving 46 articles for the third round of exclusion. The third round of exclusion based on the assessment of the titles and abstracts removed 26 articles as the articles had respondents/participants being less than 60 years of age (n = 12), the research was conducted internationally without a specific focus on Malaysia (n = 5), there was no disaggregation of data to render data specific to elderly aged 60 years and above (n = 5), were validations of measurement scales that were translated from the English Language to Bahasa Malaysia (n = 3), or were proposed study designs/control trials with no findings available (n = 2). This left a total of 20 articles for full text assessment in the fourth round of exclusion. The fourth round of exclusion removed five articles as these articles focused on physical inactivity instead of physical activity (n = 3) and activities not being defined as exercise but as relaxation (n = 2). This final round of exclusion resulted in a total of 15 articles being assessed as meeting the focus of the scoping review. The process of the selection of sources of evidence is in Figure 1.
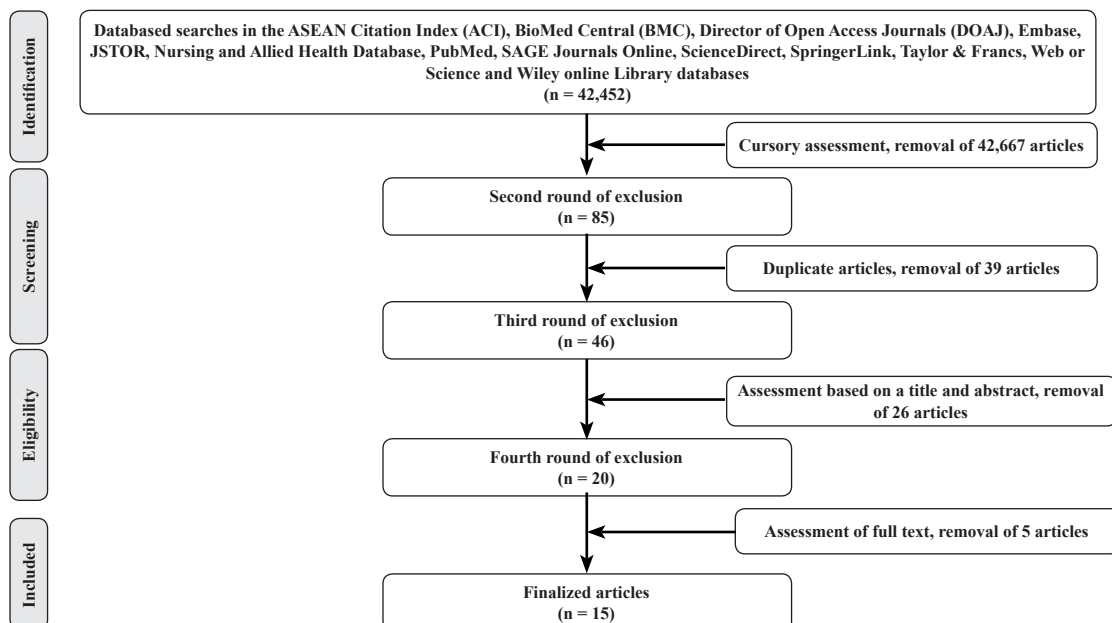

Figure 1. Flow Diagram of the Selection of Sources of Evidence

Geographic Locations of Researches

The geographic locations in Malaysia of the researches conducted in the finalized articles were Cheras, Kuala Lumpur ($n = 3$); the state of Selangor ($n = 3$); a nationwide study in Malaysia ($n = 2$); the eastern part of Peninsular Malaysia ($n=1$); Peninsular Malaysia broken into northern, southern, eastern and western zones ($n = 1$); Kuang, Selangor ($n = 1$); Kuala Pilah, Negeri Sembilan ($n = 1$); the Klang Valley ($n = 1$); Samarahan, Sarawak ($n = 1$); and a combination of Seremban, Cheras, Melaka and Taiping in the states of Negeri Sembilan, Melaka, Perak and the Federal Territory of Kuala Lumpur ($n = 1$).

Focus of Finalized Articles and Types of PAE

The focus of the research covered both physical and mental health issues pertaining to older adults aged 60 and above: effectiveness of PAE on anxiety/stress reduction and improved cognition ($n = 1$); barriers faced by the elderly in PAE to predict PAE behavior ($n = 1$); impact of submaximal level of exercise on balance performance ($n = 1$); factors associated with obesity ($n = 1$); behavioral intervention for PAE ($n = 1$); effects of combined behavioral and exercise interventions on balance as well as continuous engagement in PAE ($n = 1$); PAE and sleep disruption with Type 2 diabetes mellitus ($n = 1$); internal and external barriers to PAE participation ($n = 1$); social support and PAE ($n = 1$); PAE patterns, psychological well-being, and coping strategies in a pandemic ($n = 1$); resistance training impact on health with Type 2 diabetes mellitus ($n = 1$); effects of walking on anthropomorphic measurements ($n = 1$); peer support and personalized feedback on PAE with Type 2 diabetes mellitus ($n = 1$); and individual and combined effects of PAE and protein supplementation ($n = 1$). Specifically, the health issues focused on in the finalized articles were Type 2 diabetes mellitus ($n = 3$); cognitive impairment with reduction in anxiety and depression ($n = 1$); sarcopenia ($n = 3$); obesity ($n = 2$); balance ($n = 1$); falls ($n = 1$); cognitive frailty ($n = 1$); and three of the finalized articles did not specify a specific health issue but took into consideration overall health and health betterment ($n = 3$). Types of PAE in the finalized literature were only walking ($n = 2$); only resistance exercises using a resistance band ($n = 2$); a combination of dance and relaxation interventions (warm-up, coordinated movement, and coordinated breathing) ($n = 1$); walking and balance ($n = 1$); vigorous/moderate physical activity combined with walking ($n = 1$); a combination of cardiovascular endurance, muscle strength, balance, flexibility, and locomotor training ($n = 1$); a combination of cardiovascular exercise, balance, resistance training, and breathing ($n = 1$); a multi-component regimen of cycling, light resistance training, and gardening ($n = 1$); a combination of aerobic activity coupled with resistance band training and soy protein supplementation ($n = 1$), and unspecified ($n = 4$).

Characteristics of Respondents

All of the finalized articles had Malaysian participants aged 60 and above or had a sample of participants with a minimum mean age of 60 and above, as per the inclusion criteria of this scoping review. Where the article had both middle-aged and older adult respondents ($n = 1$), the data were disaggregated between the two age groupings in the article. Some of the finalized articles divided the respondents into experiment and control groups ($n = 5$). The respondents/participants of the research in the finalized articles were reported to be community-dwelling older adults ($n = 5$), living independently ($n = 3$), or their living arrangements were not specified ($n = 7$). The respondents of the researches in the finalized articles were a mix of the Malay, Chinese, Indian, and other ethnicities that make up the multi-ethnic fabric of Malaysian society ($n = 1$); majority of Malay ethnicity ($n = 4$); Malay ethnicity only ($n = 4$); or the ethnicity of the respondents/participants was not specified by the authors ($n = 5$).

Methods Used in the Finalized Articles

Of the 15 finalized articles, 11 used quantitative methodologies, three used qualitative methodologies, and one used a mixed-method methodology. Among these, seven finalized articles provided more detailed information regarding the research methodology approaches used: quasi-experimental research design ($n = 3$); cross sectional population based theory ($n = 1$); cross sectional study ($n = 1$); randomized control trial ($n = 1$); and three-armed randomized control trial ($n = 1$). The sampling method used by the finalized articles included a combination of purposive and convenience sampling ($n = 7$); purposive sampling only ($n = 5$); cross sectional stratified random sampling ($n = 1$); national cross sectional survey ($n = 1$); and a combination of purposive sampling and snowball technique ($n = 1$).

A variety and combinations of data collection methods and tools were used by the authors of the finalized articles. These included a self-administered Hospital Anxiety and Depression Scale (HADS) questionnaire along with Quality of Life Alzheimer's Disease test ($n = 1$); qualitative interview along with International Physical Activity Questionnaire (IPAQ) ($n = 2$); Modified Clinical Test of Sensory Integration of Balance (mTCSIB) with Borg Category-Ratio-10 (Borg CR-10) and 6-minute walk test (6MWT) ($n = 1$); International Physical Activity Questionnaire (IPAQ) and Metabolic Equivalent Test (MET) with self-administered logbook ($n = 1$); pedometer and exercise self-efficacy (ESE) scale ($n = 1$); pedometer, process of change questionnaire, Timed Up to Go (TUG) test, and Fear of Falls (FOF) test ($n = 1$); researcher administered International Physical Activity Questionnaire (IPAQ) ($n = 1$); the Barriers in Physical Activity and Exercise Participation (BPEP) questionnaire ($n = 1$); and semi-structured interview guide ($n = 1$). Also used were the International Physical Activity Questionnaire (IPAQ) administered by the researchers via telephone ($n = 1$); a self-administered logbook with tests for HbA1c, fasting blood sugar (FBG), and biochemistry analysis ($n = 1$); pedometer only ($n = 1$); pedometer with self-administered logbook and Physical Activity Scale for the Elderly (PASE) ($n = 1$); and a digital lithium scale, a height measure, measuring tape, and Senior Fitness Test (SFT) ($n = 1$).

Data analysis tools used by the researchers of the finalized articles leaned heavily on the Statistical Package for the Social Sciences (SPSS) ($n = 10$). Of these 10, SPSS was used with Bonferroni correction ($n = 1$), with structural equation modeling ($n = 1$), with multiple regression analysis ($n = 1$); with Chi-square test ($n = 1$), t-test ($n = 1$), ANOVA ($n = 1$), and with the Greenhouse-Geisser and Huynh-Feldt tests ($n = 1$); whereas three finalized articles used SPSS alone ($n = 3$). Other data analysis tools used were the Wilcoxon Signed-Rank test ($n = 1$), ANOVA with Chi-square and Bonferroni tests ($n = 1$), ANOVA with Bonferroni test ($n = 1$), and NVivo (version 11).

Main Findings in the Finalized Articles

The main findings of the 15 finalized articles may be divided into the two categories of physical and mental health. In the category of physical health, PAE reduces falls ($n = 1$), reduces sleep disruption ($n = 1$), increases weight loss and skeletal mass ($n = 1$), assists in sarcopenia management post-stroke ($n = 1$), and controls glycemic levels significantly ($n = 1$). In the mental health category, the intention to exercise is controlled by internal/external barriers/motivations ($n = 5$); PAE increases cognition while reducing symptoms of anxiety and depression ($n = 1$); and the need for customized PAE interventions and programs ($n = 2$) with special attention given to supplementation with exercise ($n = 1$) and diet/nutrition ($n = 1$).

Synthesis of the Results

The majority of research sites in the included articles were the state of Selangor, the Federal Territory of Kuala Lumpur, and the areas within the Klang Valley, indicating that past research was conducted mainly in the more cosmopolitan and industrialized areas of Peninsular Malaysia. Two nationwide studies did take into context the entire country and one research each focused on Peninsular Malaysia and Samarahan, Sarawak, East Malaysia. Excluded states (with the exception of the nationwide studies) were Kedah, Perlis, Pulau Pinang, Pahang, Johor, Kelantan, Terengganu, Sabah, and the Federal Territory of Labuan. The research covered both mental (coping strategies, peer support, behavioral change, stress/anxiety reduction) and physical health (Type 2 diabetes mellitus, falls, obesity, sleep, balance) and leaned more towards the medical sciences than the social sciences within the context of PAE. The PAE activities in the finalized articles were multi-component, focused on balance, aerobic, and anaerobic PAE. Only one research used coordinated movements (dance) as the PAE, and only one article used supplementation in tandem with PAE.

In terms of the methodology, it is noted that a wide range of research instruments and sampling methods were used. Quantitative research far outweighed qualitative and mixed methods research. Sampling leaned heavily towards the Malay ethnicity, and data collection was mainly conducted using purposive and convenience sampling. Data collection was divided between behavioral and medical tests. Data analysis heavily depended on various versions of SPSS. Overall, the findings of the research indicated that the effects and impacts of PAE on the elderly aged 60 and above in Malaysia were positive; the results also indicated that behavioral change in the elderly to be more participative in PAE is possible. Table 2 presents the mapping, analysis and synthesis of this scoping review.

Table 2

Mapping Analysis and Synthesis

No	Reference	Focus of the research	Methodology	Characteristics of the participants/ respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/ PAE intervention	Main findings of the research	Potential gap identified
1.	Adam et al., 2016	Effectiveness of a combined dance and relaxation intervention to reduce anxiety/ depression, improve cognition, and QoL.	**Methodology:** Quantitative. **Sampling:** Convenience and purposive sampling; control and intervention groups. **Data collection:** Self-administered Hospital Anxiety and Depression Scale (HADS) questionnaire, Quality of Life in Alzheimer's Disease (QOL-AD) questionnaire. **Data analysis:** SPSS v.20, ANOVA with Bonferroni correction	A total of 84 residents in four government-funded residential homes; between 60 to 80 years of age with mild to moderate cognitive impairment.	Seremban, Negeri Sembilan; Cheras, Klang Valley; Melaka, Taiping, Perak.	Cognitive impairment in elderly; reduction of anxiety and depression.	Combined dance, breathing, and relaxation Intervention.	reduced symptoms of depression and anxiety due to intervention relaxation alone did not have as much effect as when combined with dance (physical activity)	yoga and tai chi may be studied in tandem with relaxation impact of PAE on the reduction of separation anxiety, bereavement, qualitative study on PAE, and mental health nationwide study of PAE benefits
2.	Ahmad et al., 2014	Obstacles and barriers associated with exercise behavior among older adults, and predict the maintenance of exercise behavior of older adults underpinned by the theory of planned behavior (TPB).	**Methodology:** Mixed methods. **Sampling:** Focus group discussion (FGD); purposive sampling. **Data collection:** Interviews and focus group discussions. International physical activity questionnaire (IPAQ). **Data analysis:** Student's t-test, structural equation modeling using Statistical package for the Social Sciences (SPSS) v.20.	56 men, 20 women ($n = 76$) aged 60 – 75 years, government home residents. No reported terminal, chronic or mental illnesses, mainly ethnic Malays from low-income suburban areas of Kuala Lumpur.	Cheras, Kuala Lumpur.	Sarcopenia	Theraband® resistance training instruction by Theraband® Academy.	Attitude and perceived behavioral control predicted intention to exercise (men). Subjective norm, perceived behavioral control, and attitude predicted intention to exercise (women). Wanting to be healthier, family and peer support positively influenced the intention to exercise (women). Providing care for grandchildren negatively affected the intention to exercise (women).	other forms of resistance exercises and non-equipment exercises to assess intention to exercise exercise as a means of decreasing health risks/conditions differences in PAE needs and expectations between genders peer pressure/ support and impacts on exercise the efficacy of group versus solo exercise framed within TPB or cognitive behavioral therapy as an assessment to engage in exercise

Table 2 continued...

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3.	Alias & Justine, 2014	The study focused on fatigue on static balance due to a submaximal level of exercise.	**Methodology:** Quantitative. **Sampling:** Purposive and convenience sampling. **Data collection:** Modified Clinical Test of Sensory Integration of Balance (mTCSIB) was used for pre and posttest procedures. Fatigue was measured using the Borg Category-Ratio-10 scale (Borg CR-10). Level of fatigue was self-rated. Fatigue was induced by the 6-minute walk test (6MWT). **Data analysis:** Wilcoxon Signed-Rank Test.	Thirteen community-dwelling older adults aged 60 and above (6 men, 7 women) without sensory perception impairment or chronic illnesses. All the participants had a score lower than 24 on the Mini Mental State Examination (MMSE).	Cheras, Kuala Lumpur.	Balance among the elderly	Walking and maintaining balance	reported less balance on soft surfaces after fatigue was induced any prescribed exercise for older adults should be based on the level of functional capacity need for customized exercises adaptation to any walking/balance exercise program	customization of exercise programs for older adults challenges of older adults to engage in PAE due to lack of balance or if the PAE requires standing balance
4.	Ariaratnam et al., 2020	Exploration of the factors associated with obesity in older adults based on the National Health and Morbidity Survey (NHMS) 2015.	**Methodology:** Cross-sectional population-based study, quantitative. **Sampling:** Cross sectional stratified random sampling. **Data collection:** A seven-day physical activity diary using the International Physical Activity Questionnaire (IPAQ), Metabolic Equivalent of Task (MET). **Data analysis:** Statistical Package for the Social Sciences (SPSS) v.21, Multiple Regression Analysis.	A total of 3,795 older adults. The Malay ethnicity formed the largest percentage, with the Chinese, Indian, and other ethnicities following in descending order of percentage.	Malaysia	Obesity.	A combination of vigorous and moderate physical activity combined with walking.	Physical activity was not significantly negatively associated with obesity among older adults. Diet was the speculated cause of obesity.	Nationwide and statewide studies on the combination of diet and PAE to decrease obesity.

Table 2 continued...

No	Reference	Focus of the research	Methodology	Characteristics of the participants/ respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/ PAE intervention	Main findings of the research	Potential gap identified
5.	Azizan et al., 2013	Determine the effects of a behavioral program intervention following a short term introduction to exercise program, exercise adherence and exercise self-efficacy.	**Methodology:** Quasi-experimental research design, quantitative. **Sampling:** Purposive sampling. **Data collection:** Participants were divided into three groups: control, exercise, and exercise & behavior. Physical activity data was collected using a pedometer; self-efficacy data was collected using the exercise self-efficacy (ESE) scale via self-reporting. **Data analysis:** ANOVA and chi-square tests. Bonferroni test was used for mean difference.	Malay community-dwelling older adults ($n = 63$). Participants had no cognitive impairments, lived independently, were able to converse in the English Language and Bahasa Malaysia, and resided in the study setting. None of the participants were enrolled in exercise programs.	Selangor, Malaysia.	Unspecified	Cardiovascular endurance, muscle strength, balance, flexibility, and locomotor training.	behavior strategies are effective in changing behavior towards physical activity a combination of exercise and behavior change is effective in increasing physical activity, as well as the belief in the importance of exercise older adults who receive both exercise and behavioral interventions had increased self-efficacy (confidence)	body-mind connection PAE other ethnicities and in other settings self-efficacy and adherence to PAE, dietary/nutrition regimen
6.	Azizan & Justine, 2015	Examining the effects of combined behavioral and exercise interventions on balance performance and fear of falls in older adults who lived in community-based dwellings. Behavioral concepts that target the continuous engagement of older adults in exercise programs.	**Method:** Quasi-experimental study, quantitative. **Sampling:** Purposive and convenience sampling. **Data collection:** Respondents were divided into three groups, (1) exercise training and behavioral group n = 17, (2) exercise training only n = 22, and (3) control group n = 23 based on location. Pedometer and logbook in the experimental exercise groups; "processes of change" questionnaire, Timed Up and Go (TUG) test, modified Falls Efficacy Scales (mFES). **Data analysis:** Two-way repeated measures ANOVA. Bonferroni test was used for post-hoc tests.	At baseline, Malay older adults aged 60 years old and above ($n = 62$) were recruited at community centers for the study. All respondents were not involved in any exercise programs. All respondents had no cognitive impairments.	Selangor, Malaysia.	Falls.	Cardiovascular, balance, and resistance training, plus breathing exercises.	The exercise and behavioral interventions group showed the highest mean performance with balance and falls. Social contact with trainers increased the confidence in exercise and behavior performance.	Continued adherence and practice to exercise and changed behavior done longitudinally with increasing age being tested for impact on exercise and behavior. Peer-led and managed exercise and behavior interventions. Diverse ethnic, economic, and educational backgrounds of the respondents for studies on exercise among older adults.

Table 2 continued...

No	Reference	Focus of the research	Methodology	Characteristics of the participants/ respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/ PAE intervention	Main findings of the research	Potential gap identified
7.	Eshkoor et al.,(2015	Investigation of the effect of physical activity on sleep disruption among older adults with diabetes mellitus.	**Methodology:** Qualitative **Sampling:** National cross-sectional survey. **Data collection:** Researcher administered a survey. Short form International Physical Activity Questionnaire (IPAQ). **Data analysis:** Bivariate analysis using a series of Chi-square tests, Statistical Package for the Social Sciences (SPSS) v.20.	Older adults aged 60 and ($n = 502$) above diagnosed with diabetes mellitus residing in non-institutional living quarters	Peninsular Malaysia is divided into the North, South, East, and West.	Diabetes mellitus and sleep.	Moderate to high levels of exercise; type of exercise is unspecified.	Moderate to high levels of physical activity reduced sleep disruption.	Physical activity and improvement of sleep with health issues related to stress, anxiety, or depression.
8.	Justine et al., 2013	The focus of this study is the internal and external barriers to exercise participation by middle-aged and older adults.	**Methodology:** Cross-sectional study, quantitative. **Sampling:** Purposive and convenience. **Data collection:** The Barriers in Physical Activity and Exercise Participation (BPEP) questionnaire with 22 items translated into Bahasa Malaysia with internal consistency tested with Chronbach's alpha. **Data analysis:** Statistical Package for the Social Sciences (SPSS) v.16.	Malay older adults aged 60 and above (n = 60) participated in the study, 31.7% of these respondents participated in regular exercise at the time of the study.	Kuang, Selangor.	Unspecified.	Unspecified.	lack of time, facilities, and company to exercise with were the largest external barriers fatigue, lack of motivation, and being "active enough" were internal barriers	older adults of other ethnicities and their internal and external barriers to exercise data collection in other languages to test the efficacy of the BPEP questionnaire elderly above the age of 70 with no physical or cognitive impediments
9.	Marthammuthu et al., 2021	Exploring the role of social support for physical activity behavior among rural community-dwelling older women.	**Methodology:** Qualitative inductive design. **Sampling:** Purposive sampling and snowball technique among the Malaysian Elderly Mistreatment Project (MAESTRO) participants. **Data collection:** Semi-structured interview guide using Bahasa Malaysia, Tamil, and English. **Data analysis:** NVivo version 11.	A total of 17 respondents of majority Malay ethnicity (n = 13), two of Chinese and Indian ethnicity each, aged between 60 and 90 years of age.	Kuala Pilah, Negeri Sembilan.	Unspecified.	Unspecified.	adaptive social support acts as triggers to engage in exercise absence of social support may hinder engagement in exercise the media acts as an encourager of exercise engagement	use of social media messaging among older adult women to engage in exercise family participation in exercise to encourage older adult women to engage in PAE

Table 2 continued...

No	Reference	Focus of the research	Methodology	Characteristics of the participants/ respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/ PAE intervention	Main findings of the research	Potential gap identified
10.	Murukesu et al., 2021	Physical activity patterns, psychological well-being, and coping strategies of elderly persons with cognitive frailty within the context of the COVID-19 pandemic and government-imposed nationwide movement control order.	**Methodology:** Randomized control trial, quantitative. **Sampling:** Purposive, sub-group of participants in the "WE-RISE" randomized control trial. **Data collection:** Telephone interview using the International Physical Activity Questionnaire (IPAQ). **Data analysis:** Descriptive analysis with sample t-test using the Statistical Package for Social Sciences (SPSS) v.23.	Older adult Malaysians of Malay, Chinese, and Indian ethnicity aged 60 and above who participated in the "WE-RISE" trial, a randomized control trial and who lived within a community (n = 42). Twenty-one in the intervention group and 21 in the control group.	Klang Valley.	Cognitive frailty.	A multi-component exercise regimen (cycling, light resistance training, gardening, or exercises requiring moderate physical effort).	Participants in the intervention group were more physically active in terms of walking and participating in the multi-component exercise regimen and were less sedentary and better able to manage skilled tasks and daily activities.	physical frailty as a focus of intervention exercise regimens older adults above the age of 75 (mid-elderly) communities with the same demographic makeup outside of the Klang Valley qualitative research on assessing the physical activity of older adults
11.	Ooi et al., 2021	Effects of home-based progressive resistance training (PRT) using resistance bands for 16 weeks on glucose homeostasis risk and cardiovascular risk on elderly diagnosed with type 2 diabetes mellitus.	**Methodology:** Quantitative. **Sampling:** Purposive sampling based on a series of inclusion and exclusion criteria G*power 31 sample size calculation. **Data collection:** Self-administered logbook of exercise, HbA1c and fasting blood glucose (FBG) for glucose homeostasis markers, biochemistry analysis for lipid markers. **Data analysis:** Statistical package for Social Sciences (version unstated), ANOVA for mix-split design.	Older adults with type 2 diabetes were recruited using the G*power 31 sample size calculation, (n = 59) with type 2 diabetes (mean age 61.68) were recruited and divided into intervention (n = 29) and control (n = 31) groups.	Malaysia.	Type 2 diabetes mellitus.	Resistance tube training.	significant glycemic control was observed in the intervention group no significant finding was found for improvement of cardiovascular risk	advantages of cardiovascular exercise on glucose homeostasis differences in gender aerobic exercises for the elderly on glucose homeostasis and cardiovascular performance

Table 2 continued....

No	Reference	Focus of the research	Methodology	Characteristics of the participants/respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/PAE intervention	Main findings of the research	Potential gap identified
12.	Saad et al., 2021	The effects on anthropometric measurements of a 12-week walking program for older adults.	**Methodology:** Quasi-experimental study, quantitative. **Sampling:** Purposive sampling with G*power version 3.1.9.4 was used to calculate the sample size. **Data collection:** Physical activity was measured using pedometer feedback (Omron HJ 325). **Data analysis:** Statistical Package for the Social Sciences (SPSS) v.26.0 with ANOVA, Greenhouse-Geisser and Huynh-Feldt correction tests.	Participants between the ages of 60 and 75 with a body mass index (BMI) of >24.9kg/m2 with no cognitive, mobility, vision and hearing impairments; 109 participants participated and were divided into intervention (n = 48) and control (n = 61) groups. The majority of the participants were Malay.	Samarahan, Sarawak.	Obesity.	Walking with a goal of 7000 steps and weekly group walking activities.	weight loss (mean of 2.20kg) and increase in BMI (-0.94kg/m2) decrease in fat (5.52%), visceral fat (1.29%), and waist circumference (2.91cm) were noted in the intervention group an increase in skeletal muscle mass (1.67%) was also noted	Walking with older adults (above 75 years of age, below 85) combination of walking with resistance training barriers and challenges to walking by elderly
13.	Sazlina et al., 2015	Peer support and personalized feedback on physical activity patterns in improving physical activity patterns of older adults with type 2 diabetes mellitus, as well as the effect of these interventions on glycosylated hemoglobin, other cardiovascular risk factors, functional status, quality of life, and psychological well-being.	**Methodology:** Three-armed randomized control trial, qualitative. **Sampling:** Purposive and convenience sampling, sample size was determined by the G*power version 3.1.3. **Data collection:** Pedometer and one-on-one feedback, exercise diary, the Physical Activity Scale for the Elderly (PASE) questionnaire. **Data analysis:** Statistical Package for the Social Sciences (SPSS) v.20.0.	Community dwelling older adults of Malay ethnicity, above the age of 60, sedentary and diagnosed with diabetes for more than a year with other exclusion criteria.	Selangor, Malaysia.	Type 2 diabetes mellitus.	Unsupervised walking activity for a total of 12 weeks.	peer support and personalized feedback increased physical activity, with peer support indicated as having more influence on the physical activity engagement than personalized feedback the research also found a momentary decrease in blood glucose, sedentary activity, and weight circumference	peer competitiveness as an influencer of exercise participation other ethnic groups in Malaysia

Table 2 continued...

No	Reference	Focus of the research	Methodology	Characteristics of the participants/ respondents	Geographic location in Malaysia of the study	Health focus of the article	Type of PAE/ PAE intervention	Main findings of the research	Potential gap identified
14.	Shahar et al., 2013	Individual or combined effects of exercise and protein supplementation on sarcopenia among elderly.	**Methodology:** Quasi-experimental, quantitative. **Sampling:** Purposive and convenience sampling. **Data collection:** Anthropometric measurements taken using the Tanita Digital Lithium Scale HD319, SECA Leicester Portable height Measure, and SECA measuring tape; fitness was measured using the Senior Fitness Test (SFT) by Jones and Rikli, and grip strength was measured using the pinchgrip Dynamometer. **Data analysis:** Statistical Package for Social Science (SPSS) v.17.	Older adults with sarcopenia aged 60 and above (*n* = 65, men *n* = 47, women *n* = 18) with no terminal illness. Participants were divided into four groups (exercise only, protein supplementation only, combined protein supplementation and exercise, and control).	Cheras, Kuala Lumpur.	Sarcopenia.	Moderately intensive exercise combining general warm-up/aerobic exercises, balance exercises, resistance exercise using Theraband®, and cool down/ relaxation exercises. Soy protein was provided in the form of a soy protein drink. Control group was given only relaxation exercises.	participants who received protein supplementation showed the highest rate of body weight reduction well-rounded exercise showed a reduction in weight, as well as an increase in muscle mass there were improvements in strength, agility, and dynamic balance	other supplementation, nutrition, and diet to accompany PAE PAE as a component of overall health management for other diseases
15	Wong et al., 2022	Prevalence of possible sarcopenia among older stroke survivors.	**Methodology:** Quantitative. **Sampling:** Convenience sampling. **Data collection:** International Physical Activity Questionnaire (IPAQ). **Data analysis:** Binary logistical regression analysis.	Stroke survivors (n=196) with mean age of 67.60.	East coast of Peninsular Malaysia.	Sarcopenia	Unspecified.	older adults with stroke require more PAE	PAE remains important to stroke survivors post stroke in managing sarcopenia

Discussion

Summary of Evidence

Based on the analysis, three gaps are immediately apparent: (a) the need to address the gap in terms of the use of qualitative research methods; (b) the gap in the use of social media and information technology (IT) in research pertaining to older adults aged 60 and above and PAE as IT is an integral part of life in the present day; and (c) the gap where not all geographic areas of Malaysia have been sites for such research. The first gap can be addressed in future research in a straightforward way by utilizing more qualitative approaches to research on the subject. By using qualitative approaches to research, scholars will be more in touch with the lived, everyday experiences of the elderly when it comes to their use of PAE for health purposes. Having qualitative data would allow for better customization of PAE public health efforts and cognizance of lived challenges to PAE efforts. This would enrich and complement the present quantitative body of literature on the subject. The second gap may be addressed by conducting studies on the effectiveness and challenges of social media and IT use to increase awareness of the importance of PAE, disseminate older adult-friendly PAE programs, and create networks to encourage participation in PAE to enhance or maintain their level of health. The third gap may be addressed by having research on PAE and health conducted in states or areas where such research has not been conducted.

However, the other gaps identified by this scoping review call for more detailed approaches. The first of these gaps identified is that the studies in the included articles are not longitudinal in nature. Therefore, this gap can be addressed by longitudinal studies (studies focused on a population over a prolonged period), for example, the works of Alex et al. (2018), Goh et al. (2017), Wu et al. (2021), and Gour et al. (2020). This is especially relevant as the older adult population will not only increase in Malaysia, but the present population aged 60 and above will continue aging (indicating a steady decline in cognitive and physical function), necessitating longitudinal research that can duly inform academia regarding the changes of the health of elderly and the PAE needs, challenges, adherence, and necessary interventions. The second gap identified by the mapping out and analysis of the finalized articles indicates that the main health issues focused on have been mainly Type 2 diabetes mellitus, falls, balance, and obesity—but these may not be the only health issues/diseases of concern when the health of elderly comes into question. Considering that hypertension, dyslipidemia, and cancer, along with diabetes mellitus, are leading diseases among older adults (Ghazali et al., 2021), future studies should focus on the use of PAE to reduce the incidence rate and act as interventions for the reduction of these diseases.

A third gap found in the analysis of the finalized articles was the focus of the research on a specific ethnic group and the assumed homogeneity of the elderly in Malaysia. Future research could consider including participants from the diverse ethnic groups of Malaysia, including the indigenous tribes of Malaysia. Additionally, future research could focus on the PAE and health of the elderly in Malaysia from different socioeconomic, education, and past/present employment backgrounds. Also, the homogeneity in terms of gender can be further challenged by conducting research that broached the topic of the differences in perceptions of PAE, PAE, and health intervention needs, as well as barriers and challenges faced between cisgender male and female elderly aged 60 and above. Both homogeneity of ethnicity and gender gaps can be addressed via longitudinal studies focused on the relationships between physical activity, health, and the gender of older adults; changes and diversity in the ethnic composition of Malaysia and the implications of these changes on the use of PAE and health; and the long term implications socioeconomic, education, and past/present employment on the use of PAE and health among older adults.

The fourth gap identified was the lack of customization of PAE to increase health. On an individual level, older adults may seek personalized customization of PAE. Future studies could address this gap by conducting research that hones in on the individualization of PAE in terms of needs, barriers, and challenges to PAE adherence, as well as customized nutritional and supplemental needs. The author recognizes such research would be extremely micro in nature; therefore, this proposed future research could take the form of a pilot study or inductive research that seeks out the lived experiences and needs of PAE for health among Malaysians aged 60 and above.

The fifth gap identified via the analysis of the finalized articles was the limited number of types of PAE used in the research (mainly walking, resistance band use, and PAE to enhance balance). This gap

may be addressed through research that uses PAE that promotes a body-mind connection and coordination, such as yoga and tai chi. Yoga and tai chi are commonly found in Malaysia and could be used to enhance health, especially when combined with relaxation. Additionally, the body-mind connection PAE could potentially be used for research that seeks to address the question of quality of life (QoL), especially from phenomenological (lived experience) and qualitative perspectives. Such a research endeavor would also add to the body of literature regarding the mental health of the elderly and its connection with PAE.

Limitations

As the focus was on the use of PAE and not a combination of PAE and nutrition, there could be some oversight in terms of studies on PAE and the elderly in Malaysia. A future scoping review on the status of the use of PAE and nutrition may be undertaken by the author to address this limitation. The author's search using the Bahasa Malaysia keywords mentioned in the early part of this manuscript proved irrelevant as the use of these Bahasa Malaysia keywords yielded no results in the database searches. The author will reassess the necessity for Bahasa Malaysia keywords for future research where Malaysia is the geographic context. The author takes note that all of the finalized articles were published approximately within the last 10 years. This limitation could be due to the health issues of older people not being a major health concern until approximately a dozen years ago when their number exponentially rose, as predicted by Mafauzy (2000), and began to manifest health issues of pressing concern in Malaysian society.

Conclusion

The scoping review indicates the need for relevant, timely, and well-informed research to assist in addressing the health issues that will come with the growth of the aging demographic in Malaysia. The prevalence of diabetes, hypercholesterolemia, cardiovascular issues, and dementia may be decreased through the effective use of PAE. By diversifying the present body of academic literature based on the findings of this scoping review, scholars and relevant stakeholders may conduct future research that is diverse and assists in meeting the health challenges faced by the older adult population in Malaysia. Additionally, the older adult population may be more engaged in decisions pertaining to their own health, as well as playing the role of stakeholders in their own positive health outcomes. PAE as a public health intervention tool may seem innocuous when compared to sophisticated medical technology, but it is a relevant, cost-effective, and efficient means of maintaining and preserving health in the era of a global aging population.

The extracted data of this scoping review indicates the presence of public health interventions in the form of PAE for older adults in Malaysia. But, based on the gaps identified, more comprehensive efforts may be made through the efforts of academics and other relevant stakeholders to use PAE as a public health intervention. As the global health situation will demand more health interventions for the aging population, more efforts need to be made in the form of health prevention and interventions in the context of health management and preservation of older adults in Malaysia.

Declaration of Ownership

This manuscript is the original work of the author.

Conflict of Interest

None.

Ethical Clearance

The study was approved by the Internal Review Board (MU-SSIRB) of the Faculty of Social Sciences and Humanities, Mahidol University (certificate number: 2020/023.2608).

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References

Ab Majid, N. L., Rodzlan Hasani, W. S., Mat Rifin, H., Robert Lourdes, T. G., Ling, J. M. Y., Saminanthan, T. A., Hasimah, I., & Mohd Yusoff, M. F. (2020). Self-reported diabetes, hypertension and hypercholesterolemia among older persons in Malaysia. *Geriatrics & Gerontology International*, *20*(S2), 79–84. https://doi.org/10.1111/ggi.13968

Adam, D., Ramli, A., & Shahar, S. (2016). Effectiveness of a combined dance and relaxation intervention on reducing anxiety and depression and improving quality of life among the cognitively impaired elderly. *Sultan Qaboos University Medical Journal*, *16*(1), e47–e53. https://doi.org/10.18295/squmj.2016.16.01.009

Ahmad, M. H., Shahar, S., Teng, N. I. M. F., Manaf, Z. A., Sakian, N. I. M., & Omar, B. (2014). Applying theory of planned behavior to predict exercise maintenance in sarcopenic elderly. *Clinical Interventions in Aging*, *9*, 1551–1561. http://dx.doi.org/10.2147/CIA.S60462

Alex, D., Khor, H. M., Chin, A. V., Hairi, N. N., Othman, S., Khoo, S. P. K., Kamaruzzaman, S. B., & Tan, M. P. (2018). Cross-sectional analysis of ethnic differences in fall prevalence in urban dwellers aged 55 years and over in the Malaysian elders longitudinal research study. *BMJ Open*, *8*(7), 1–6. https://doi.org/10.1136/bmjopen-2017-019579

Alias, H. A., & Justine, M. (2014). The impact of a submaximal level of exercise on balance performance in older persons. *The Scientific World Journal*, *2014*, Article ID 986252. http://dx.doi.org/10.1155/2014/986252

Ariaratnam, S., Rodzlan Hasani, W. S., Krishnapillai, A. D., Abd Hamid, H. A., Jane Ling, M. Y., Ho, B. K., Shariff Ghazali, S., Noorlaili, Muhammad Tohit, N., & Mohd Yusoff, M. F. (2020). Prevalence of obesity and its associated risk factors among the elderly in Malaysia: Findings from The National Health and Morbidity Survey (NHMS) 2015. *Plos One*, *15*(9), 1–9. https://doi.org/10.1371/journal.pone.0238566

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, *8*(1), 19–32.

Azizan, A., Justine, M., & Kuan, C. S. (2013). Effects of a behavioral program on exercise adherence and exercise self-efficacy in community-dwelling older persons. *Current Gerontology and Geriatrics Research*, *2013*, Article ID 282315. http://dx.doi.org/10.1155/2013/282315

Azizan, A., & Justine, M. (2015). Elders' exercise and behavioral program: Effects on balance and fear of falls. *Physical & Occupational Therapy in Geriatrics*, *33*(4), 346–362. https://doi.org/10.3109/02703181.2015.1093060

Baharudin@Shaharuddin, A., Abdul Aziz, N. S., Ahmad, M. H., Manjit Singh, J. S., Chan, Y. Y., Palaniveloo, L., Chee, C. K., Norlida, Z., Wong, N. I., Ruhaya, S., & Selamat, R. (2020). Abdominal obesity and its associated factors among elderly in Malaysia. *Geriatrics & Gerontology International*, *20*(S2), 68–72. https://doi.org/10.1111/ggi.13962

Chan, Y. Y., Sooryanarayana, R., Kasim, N. M., Lim, K. K., Cheong, S. M., Kee, C. C., Lim, K. H., Omar, M. A., Ahmad, N. A., & Hairi, N. N. M. (2019). Prevalence and correlates of physical inactivity among elderly in Malaysia: Findings from the National Health and Morbidity Survey (NHMS) 2015. *Archives of Gerontology and Geriatrics*, *81*, 74–83. https://doi.org/10.1016/j.archger.2018.11.012

Chan, Y. Y., Lim, K. K., Omar, M. A., Mohd Yusoff, M. F., Sooryanarayana, R., Ahmad, N. A., Abd Razak, N. A., Baharudin@Shaharuddin, A., Mahmud, N. A., Fikri Mahmud, N. A., Abdul Mutalip, M. A., & Mohd Hairi, N. N. (2020). Prevalence and factors associated with physical inactivity among elderly in Malaysia: A cross-sectional study. *Geriatrics & Gerontology International*, *20*, 49–56. https://doi.org/10.1111/ggi.13977

Chen, N., He, X., Feng, Y., Ainsworth, B. E., & Liu, Y. (2021). Effects of resistance training in healthy older people with sarcopenia: A systematic review and meta-analysis of randomized controlled trials. *European Review of Aging and Physical Activity*, *18*(1), Article 23. https://doi.org/10.1186/s11556-021-00277-7

Chen, P. Y., Song, C. Y., Yen, H. Y., Lin, P. C., Chen, S. R., Lu, L. H., Tien, C. L., Wang, X. M., & Lin, C. H. (2021). Impacts of tai chi exercise on functional fitness in community-dwelling elderly with mild degenerative knee osteoarthritis: A randomized controlled clinical trial. *BMC Geriatrics*, *21*(1), Article 449. https://doi.org/10.1186/s12877-021-02390-9

Cho, D., & Kim, S. H. (2020). Health capability and psychological effects of regular exercise on adults: Middle-aged and older. *The International Journal of Aging and Human Development*, *91*(4), 520–537. https://doi.org/10.1177/0091415019882009

Dean, E., Söderlund, A., Gosselink, R., Jones, A. Y., Yu, H. P. M., & Skinner, M. (2021). Immuno-modulation with lifestyle behaviour change to reduce SARS-CoV-2 susceptibility and COVID-19 severity: Goals consistent with contemporary physiotherapy practice. *Physiotherapy, 114*, 63–67. https://doi.org/10.1016/j.physio.2021.08.006

Di Lorito, C., Long, A., Byrne, A., Harwood, R. H., Gladman, J. R., Schneider, S., Logan, P., Bosco, A., & van der Wardt, V. (2021). Exercise interventions for elderly: A systematic review of meta-analyses. *Journal of Sport and Health Science*, *10*(1), 29–47. https://doi.org/10.1016/j.jshs.2020.06.003

dos Reis Caldas, L. R., Albuquerque, M. R., Lopes, E., Moreira, A. C., Almada, T. G. B., de Araújo, S. R., de Oliveira, A. B. C., Ribeiro, A. Q., & Carneiro-Júnior, M. A. (2021). Multi-component exercise training is effective in improving health and behavior indicators in Brazilian elderly women: A non-randomized trial. *Journal of Bodywork and Movement Therapies, 29*, 40–48. https://doi.org/10.1016/j.jbmt.2021.09.030

Eshkoor, S. A., Hamid, T. A., Nudin, S. S. A. H., & Mun, C. Y. (2015). Can physical activity affect sleep disruption among the elderly with diabetes mellitus? *International Journal of Diabetes in Developing Countries*, *35*(2), 271–274. https://doi.org/10.1007/s13410-015-0364-6

Ghazali, S. S., Seman, Z., Zainuddin, N. H., Omar, M. A., Sooryanarayana, R., Ariaratnam, S., Tohit, N. M., Ho, B. K., Krishnapillai, A. D., & Abidin, S. I. Z. (2021). Prevalence and factors associated with multimorbidity among elderly in Malaysia: A population-based cross-sectional study. *BMJ Open*, *11*(10), Article e052126. https://doi.org/10.1136/bmjopen-2021-052126

Goh, C. H., Ng, S. C., Kamaruzzaman, S. B., Chin, A. V., & Tan, M. P. (2017). Standing beat-to-beat blood pressure variability is reduced among fallers in the Malaysian elders longitudinal study. *Medicine*, *96*(42), Article e8193. https://doi.org/10.1097/MD.0000000000008193

Gour, P., Choudhary, A., Sahoo, K. C., Jirwe, M., Hallgren, M., Diwan, V. K., Mahadik, V. K., & Diwan, V. (2020). Experience of elderly people regarding the effect of yoga/light exercise on sedentary behavior: A longitudinal qualitative study in Madhya Pradesh, India. *Geriatrics*, *5*(4), 103. https://doi.org/10.3390/geriatrics5040103

Hayashi, C., Toyoda, H., Ogata, S., Okano, T., & Mashino, S. (2021). Long-term participation in community-based group resistance exercises delays the transition from robustness to frailty in elderly: A retrospective cohort study. *Environmental Health and Preventive Medicine*, *26*(1), 1–9.

Iddrisu, M. A., Senadjki, A., Remendran, C., Yong, H. N. A., Yew, K. T., & Poulsaeman, V. (2020). Factors of health promotion behaviour (HPB) and elderly health diseases in Malaysia. *Journal of Population Ageing, 15*, 141–171. https://doi.org/10.1007/s12062-020-09284-5

Justine, M., Azizan, A., Hassan, V., Salleh, Z. & Manaf, H. (2013). Barriers to participation in physical activity and exercise among middle-aged and elderly individuals. *Singapore Medical Journal*, *54*(10), 581–586. https://doi.org/10.11622/smedj.2013203

Kowal, P. R., Peachey, K., & World Health Organization. (2001). Information needs for research, policy and action on ageing and elderly: A report of the follow-up meeting to the 2000 Harare MDS Workshop: Indicators for the minimum data set project on ageing: A critical review in sub-Saharan Africa, 21 and 22 June 2001, Dar es Salaam, United Republic of Tanzania.

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, *5*(1), Article 69.

Liang, Y., Li, X., Yang, T., Li, M., Ruan, Y., Yang, Y., Huang, Y., Jiang, Y., & Wang, Y. (2021). Patterns of physical activity and their relationship with depression among community-dwelling elderly in Shanghai, China: A latent class approach. *BMC Geriatrics*, *21*(1), Article 587. https://doi.org/10.1186/s12877-021-02537-8

Mafauzy, M. (2000). The problems and challenges of the aging population of Malaysia. *The Malaysian Journal of Medical Sciences*, *7*(1), 1–3.

Marthammuthu, T., Hairi, F. M., Choo, W. Y., Salleh, N. A. M., & Hairi, N. N. (2021). A qualitative investigation on the roles of social support on physical activity behaviour among the rural-dwelling older women in Malaysia. *International Journal of Environmental Research and Public Health*, *18*(18), Article 9609. https://doi.org/10.3390/ijerph18189609

Minhat, H. S., & Amin, R. M. (2012). Sociodemographic determinants of leisure participation among elderly in Malaysia. *Journal of Community Health*, *37*(4), 840–847.

Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, *18*(1), Article No. 143.

Murukesu, R. R., Singh, D. K. A., Shahar, S., & Subramaniam, P. (2021). Physical activity patterns, psychosocial well-being and coping strategies among older persons with cognitive frailty of the "WE-RISE" trial throughout the COVID-19 movement control order. *Clinical Interventions in Aging*, *2021*(16), 415–429. http://doi.org/10.2147/CIA.S290851

NoorAni, A., Rajini, S., Balkish, M. N., Noraida, M. K., SMaria, A., Fadhli, M. Y., Jabrullah, A. H., & Tahir, A. (2018). Morbidity patterns and healthcare utilisation among older people in Malaysia: 1996–2015. *Public Health*, *163*, 105–112. https://doi.org/10.1016/j.puhe.2018.06.018

Ooi, T. C., Mat Ludin, A. F., Loke, S. C., Fiatarone Singh, M. A., Wong, T. W., Vytialingam, N., Abdullah, M. M. J. A., Ng, O. C., Bahar, N., Zainudin, N., & Lew, L. C. (2021). A 16-week home-based progressive resistance tube training among elderly with type-2 diabetes mellitus: Effect on glycemic control. *Gerontology and Geriatric Medicine*, *7*, 1-10. https://doi.org/10.1177/23337214211038789

Orimo, H., Ito, H., Suzuki, T., Araki, A., Hosoi, T., & Sawabe, M. (2006). Reviewing the definition of "elderly". *Geriatrics & Gerontology International*, *6*(3), 149–158.

Rezaeipour, M. (2021). Effects of two water-based exercise programs on body weight and blood lipid parameters

in elderly obese males with a sedentary lifestyle. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *15*(4), Article 102194. https://doi.org/10.1016/j.dsx.2021.102194

Ribeiro, I. S., Pereira, Í. S., Galantini, M. P., Santos, D. P., Teles, M. F., Muniz, I. P., Santos, G. S., & Silva, R. A. (2021). Regular physical activity reduces the effects of inflammaging in diabetic and hypertensive men. *Experimental Gerontology*, *155*, Article 111558. https://doi.org/10.1016/j.exger.2021.111558

Saad, M. F., Cheah, W. L., & Hazmi, H. (2021). The effects of a 7000-step goal and weekly group walking program for overweight and obese elderly people in Sarawak, Malaysia: A quasi-experimental study. *Journal of Preventive Medicine and Public Health*, *54*(3), 199–207. https://doi.org/10.3961/jpmph.20.584

Sazlina, S. G., Browning, C. J., & Yasin, S. (2015). Effectiveness of personalized feedback alone or combined with peer support to improve physical activity in sedentary older Malays with type 2 diabetes: A randomized controlled trial. *Frontiers in Public Health*, *3*. https://doi.org/10.3389/fpubh.2015.00178

Sazlina, S. G., Sooryanarayana, R., Ho, B. K., Omar, M. A., Krishnapillai, A. D., Mohd Tohit, N., Zainal Abidin, S. I., & Ahmad, N. A. (2020). Cardiovascular disease risk factors among older people: Data from the National Health and Morbidity Survey 2015. *PloS one*, *15*(10), Article e0240826 https://doi.org/10.1371/journal.pone.0240826

Shahar, S., Kamaruddin, N. S., Badrasawi, M., Sakian, N. I. M., Abd Manaf, Z., Yassin, Z., & Joseph, L. (2013). Effectiveness of exercise and protein supplementation intervention on body composition, functional fitness, and oxidative stress among elderly Malays with sarcopenia. *Clinical Interventions in Aging*, *2013*(8), 1365–1375. http://dx.doi.org/10.2147/CIA.S46826

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsely, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garrity, C., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473.

Widjaja, W., Wongwattanapong, T., Laskin, J. J., & Ajjimaporn, A. (2021). Benefits of Thai yoga on physical mobility and lower limb muscle strength in overweight/obese older women: A randomized controlled pilot trial. *Complementary Therapies in Clinical Practice*, *43*, Article 101345. https://doi.org/10.1016/j.ctcp.2021.101345

Wong, H. J., Harith, S., Lua, P. L., & Ibrahim, K. A. (2022). Possible sarcopenia and its association with nutritional status, dietary intakes, physical activity and health-related quality of life among older stroke survivors. *Annals of Geriatric Medicine and Research*, *26*(2), 162–174. https://doi.org/10.4235/agmr.22.0033

Wu, Z., Zhang, H., Miao, X., Li, H., Pan, H., Zhou, D., Liu, Y., Li, Z., Wang, J., Liu, X., Zheng, D., Li, X., Wang, W., Guo, X., & Tao, L. (2021). High-intensity physical activity is not associated with better cognition in the elder: Evidence from the China health and retirement longitudinal study. *Alzheimer's Research & Therapy*, *13*(1), Article 182. https://doi.org/10.1186/s13195-021-00923-3