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Original Article

Risk Factors of Frailty Among Multi-Ethnic Malaysian Older Adults

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SUMMARY

Background: Malaysia is experiencing an increase in the percentage of older people who have a higher life expectancy. However, information regarding the prevalence and risk factors of frailty is scarce for Malaysian older adults. The aim of this cross-sectional study is to determine the prevalence and risk factors of frailty among multi-ethnic community dwellings for older adults in Malaysia.
Methods: A total of 473 older adults aged 60 years and above (210 men and 263 women) were randomly selected from 10 different areas in the Klang Valley of Malaysia. The respondents were screened at selected community centres; their frailty status was defined using Fried's criteria. Respondents were assessed for their physical functional status using selected parameters of a senior fitness test and other physical performance tests regarding their activities in daily life. Anthropometric measurements, cognitive function and symptoms of depression were also assessed for each respondent.
Results: The prevalence of frailty was 8.9% and of pre-frailty was 61.7%, with women having a higher prevalence compared to men ($p < 0.01$). Binary logistic regression analyses showed that female gender, abdominal obesity, low peak respiratory flow rate score and slower rapid pace gait speed were significant predictors of frailty.
Conclusion: Frailty affected about one tenth of the respondents, but almost two thirds were pre-frail. In addition to gender, other modifiable factors including abdominal obesity and poor physical function were identified as risk factors for frailty and pre-frailty among Malaysian older adults.

1. Introduction

In 2012 there were around 810 million older adults aged 60 and above in the world and this number is expected to increase[1]. Therefore, it is pressing to provide comprehensive information for evidence based strategies to maintain physical and cognitive function and decrease the level of disability in older adults[2]. Frailty is a relatively new concept in the geriatric field and it is considered to be one of the major risk factors of disability in older adults[3]. Frailty is defined as "a biological syndrome of decreased reserve and resistance stressors, characterized by muscle weakness, sarcopenia and fatigue" and is associated with several adverse health outcomes[4]. There are serious consequences of frailty in older individuals, their families and society as they are at the midway between independence and disability, hospitalization and mortality[5]. Risk factors of frailty identified in different communities so far include old age[6–9], ethnicity[8,10], co-morbidities[7–9], economic status and educational level[6,10].

Noticeably, Malaysia is witnessing an increase in the percentage of older people aged 60 years and above due to considerable socioeconomic and demographic transmutation[11]. Malaysia is expected to transform to an aging population by the year 2020, with older adults making up 11.3% of the total population[12]. A recent study among older Malaysian urban dwellers indicated that frailty affected 5.7%, with physical function disability, falls and cognitive impairment found to be the risk factors[13]. However, this study employed a convenient sampling method and the contribution of nutrition and physical function were not investigated adequately. These risk factors are potentially modifiable factors that need to be addressed by public health strategies. Thus, the aim of this study is to determine the prevalence of frailty and its related risk factors through a wide range of physical, cognitive and nutritional factors among multi-ethnic Malaysian older adults recruited through a multistage random sampling.

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2. Materials and methods

This study is part of a longitudinal study on a neuroprotective model for healthy longevity among Malaysian older adults, as previously published[14]. The study protocol was approved by the Ethics Committee of the Ministry of Health, Malaysia. Respondents were selected using a multistage random sampling from ten urban and rural districts, in which older adults formed 10% or more of the total population, this being a representative sample of community-dwelling older individuals and comprising the three main ethnic groups (Malays, Chinese and Indians)[11]. Eligible older adults aged 60 years and above with no known terminal or mental illnesses were visited at the homes and invited to join a health screening session at community centres (Fig. 1). Of the 650 invited, 574 participated and signed the consent form. Data was collected from 15th July 2013 to 22nd February 2014. Respondents were interviewed regarding their sociodemographic data, and they were asked to report if they had been diagnosed with any chronic diseases or other medical problems. Participants who had medical problems that prevented them from performing the physical functional assessment, acute illness during the data collection, low MMSE score (<16) or who were unable to follow the instructions when performing the measurements, were excluded from the study.

The frailty assessment was done using Fried's criteria[10]. It consists of five components: shrinking (subjective report of unintentional weight loss of 5 kg and above over the last year); weakness (hand grip is less than the cut-off points mentioned on the original reference, adjusted for gender and body mass index); exhaustion and poor endurance and energy (indicated by self-reporting of exhaustion, identified by two questions from the CES-D scale); slowness (gait speed more than the cut-off points mentioned on the original reference, adjusted for gender and height); and low physical activity, identified by low scores (in the lowest tertile) of the physical activity scale for elderly (PASE).

Anthropometric measurements included weight, height, mid upper arm circumference (MUAC) and calf circumference (CC). All measurements were taken twice using the standard method[15]. The physical functional status assessment included activities of daily living, instrumental activities of daily living and selected parameters in the senior fitness test[16], including a 2-min step for endurance, hand grip and shoulder strength for upper body strength, chair stand for lower body strength, set and reach for lower body flexibility, back scratch for upper body flexibility, time up and go test for balance and mobility status, normal and rapid pace gait speed test and, in addition, peak expiratory flow test for respiratory function. The impairment in any of the physical function tests were determined by the lowest percentile of the total sample. The activity of daily living (ADL) using the Barthel Index Score[17] and instrumental activity of daily living (IADL) using Lawton IADL[18] were also obtained. Cognitive function was assessed with the mini mental status examination (MMSE), using the validated Malaysian version[19]. Depressive symptoms were screened using the short version of the geriatric depression scale (GDS-15), with those scoring 5 or above of the total score of 15 categorised as having depressive symptoms[20]. A total of 20 ml of blood was collected in different tubes by a trained phlebotomist. Albumin, fasting blood sugars (FBS), glycosylated haemoglobin (HBA1c) and lipid profiles were conducted at the Path Lab–Pathology and Clinical Laboratory (m), Sdn Bhd, Klang Valley branch, Malaysia.

All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) software, version 21.0. An alpha level of (0.05) was considered for all the statistical tests used in the study. Two sided p values of (0.05) and (80%) power were considered to be statistically significant. In order to determine the frailty risk factors, a univariate analysis using the chi square test was performed. Further analysis using hierarchical binary logistic regression was done to determine the frailty risk factors in a multivariate model. The logistic assumptions multicollinearities and outliers were checked. Hosmer-Lemeshow goodness of fit test was employed to assess how well the model fit the data.

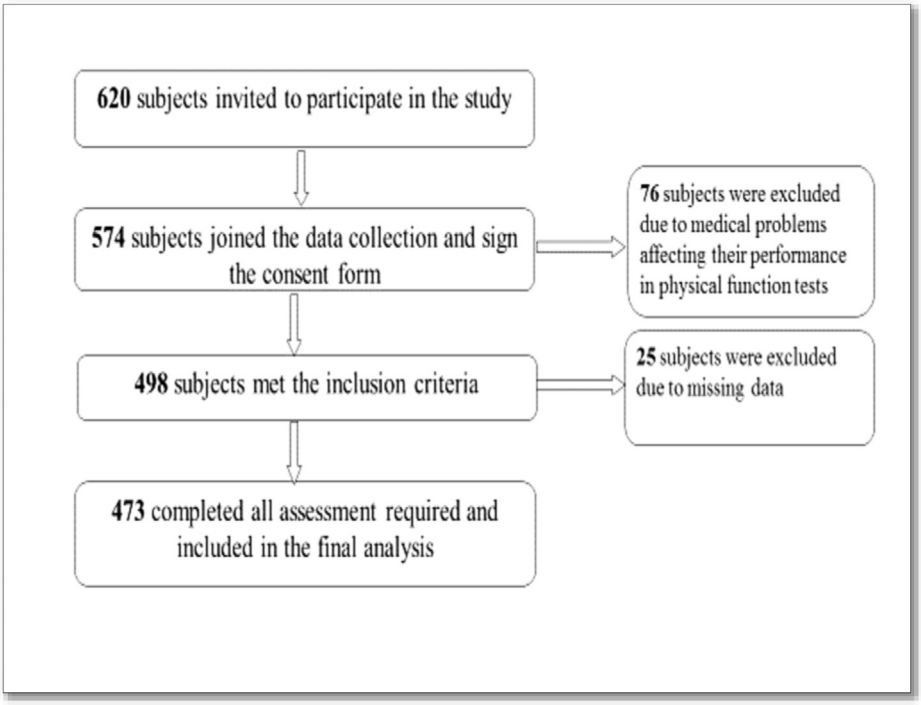

Fig. 1. Participant's recruitment flow chart.

3. Results

Of the 650 initially invited for screening, 574 participated (response rate 88.3%). However, 76 were excluded due to medical problems and 25 due to missing data, thus a total of 473 (210 men and 263 women) were included in the final analysis. The mean age for men and women was 68.9 ± 5.9 and 67.3 ± 5.7 years, respectively. As shown in Fig. 2, the prevalence of frailty and pre-frailty was 8.9% and 61.7%, respectively, with a higher prevalence in women ($p < 0.01$). In terms of frailty subdomains, weakness was the most predominant subdomain, followed by low physical activity, feeling of exhaustion, slowness, whilst the lowest predominant subdomain was weight loss (Fig. 3).

The results of the univariate and multivariate analyses for the socio demographic variables showed that only the female gender was associated with frailty, as shown in Table 1. With respect to the medical and clinical profiles, low HDL levels were associated with being frail or pre-frail in the univariate analysis only (Table 2). The lowest percentile of the physical function tests showed significant association with frailty, with the exception of shoulder strength. In the multivariate analysis, only the lowest percentile of the chair stand test, peak expiratory flow rate and rapid pace gait speed were shown to be significant predictors of frailty (Table 3). In terms of anthropometric measurements, obesity and abdominal obesity showed significant association with frailty in both the univariate and multivariate models (Table 4).

Furthermore, Table 5 shows the final model, where gender, abdominal obesity, lower rapid pace gait speed and lower peak expiratory flow rate score were found to be significant predictors of frailty ($p < 0.05$).

4. Discussion

This study has successfully determined a prevalence of frailty of 8.9%, which is slightly higher than the findings in the previous studies among Malaysian older adults in urban areas (5.7%)[13], community studies in Korea (3.9%)[21], Taiwan (8.3%)[22] and Singapore (5%)[6]. The differences in prevalence of frailty among Asian communities might be due to differences in participant selection methods, sample size, frailty assessment tools used, the cut-off points of physical function used and the age of the participants.

As reported in other studies[5,10], the present study also found that women were more likely to be frail. This could be due to a lower muscle mass[23] and the fact that women lose their lean body mass with aging faster than men[24]. Lower levels of education in women may act as one of the contributing factors, as has been reported in the literature[25].

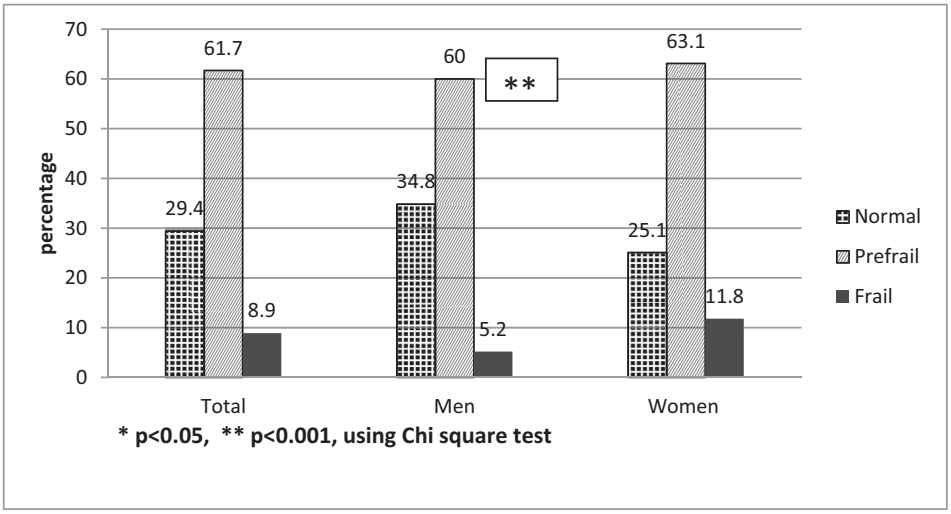

Fig. 2. Frailty prevalence according to gender.

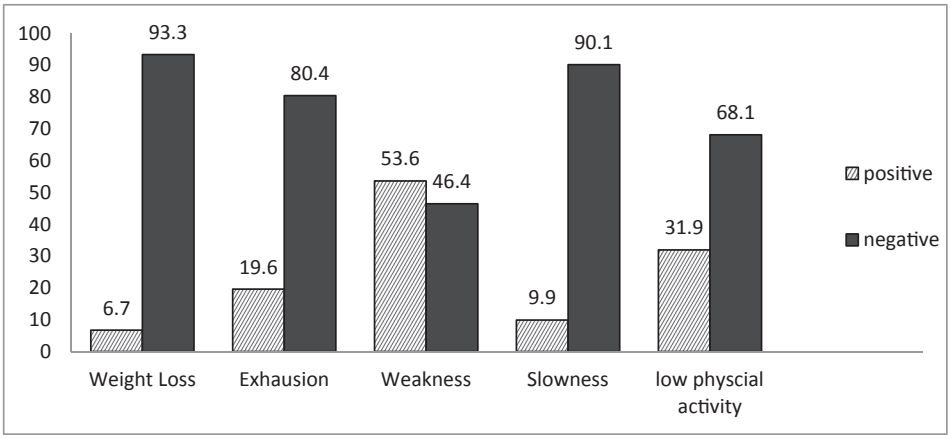

Fig. 3. Frailty criteria distribution.

Table 1
Sociodemographic variables associated with frailty.

Factors	Univariate analysis[a]		Multivariate analysis[b]		
	OR (95%CI)	P value	Exp B (95%CI)	P value	Exp B
Gender					
Men	1.59 (1.06–2.36)	0.014*	2.16 (1.19–3.28)	0.000**	2.38
women					
Age					
60–70	1.28 (0.84–1.94)	0.245	1.01 (0.95–1.05)		
>70					
Ethnicity					
Malay and Indian	1.01 (0.68–1.50)	0.517	1.13 (0.69–1.80)		
Chinese					
Marital status					
Married	0.781 (0.48–1.25)	0.18	1.25 (0.65–2.16)		
Not Married					
Living status					
Alone	0.98 (0.67–1.59)	0.057	1.04 (0.53–2.84)		
With family					
Working status					
Working	1.44 (0.807–2.5)	0.264	1.28 (0.65–2.42)		
Not working					
Monthly income					
Low (<1500 rm)	1.35 (0.85–1.93)	0.133	1.21 (0.89–2.02)		
Moderate- high (>1500 rm)					

*p < 0.05, **p < 0.01 using Chi square test/Binary logistic regression test.
[a] Univariate analysis using Chi square test.
[b] Multivariate analysis using Binary logistic regression.

Table 2
Medical and clinical profiles associated with frailty.

Factors	Univariate analysis[a]		Mutivariate analysis[b]		
	OR (95%CI)	P value	Exp B (95%CI)	P value	Exp B
Hypertension					
Yes	1.35 (0.91–2.01)	0.084	1.33 (0.83–2.1)	0.00***	2.41
No					
Diabetes mellitus					
Yes	1.31 (0.85–2.02)	0.132	1.16 (0.73–1.85)		
No					
Dyslipidemia					
Yes	1.38 (0.91–2.08)	0.077	1.28 (0.81–2.01)		
No					
Heart disease					
Yes	1.66 (0.80–3.43)	0.112	1.47 (0.76–2.83)		
No					
Biochemical indices					
Hyperglycemia					
FGB>5.6 mmol/l	1.21 (0.78–1.87)	0.230	1.18 (0.74–1.81)		
FGB<5.6 mmol/l					
Low Albumin					
<30 g/l	NA	NA	1.03 (0.934–1.18)		
>30 g/l					
High cholesterol					
>5.2 mmol/l	0.973 (0.564–1.45)	0.309	1.069 (0.519–2.204)		
<5.2 mmol/l					
High LDL					
>2.6 mmol/l	1.068 (0.679–1.68)	0.431	1.007 (0.48–2.10)		
<2.6 mmol/l					
Low HDL					
<1.04 mmol/l	1.99 (0.99–4.1)	0.032*	2.56 (0.89–7.37)		
>1.04 mmol/l					
High TC:HDL					
>5	0.974 (0.516–1.84)	0.527	1.75 (0.628–4.881)		
<5					
High triglyceride					
>1.7 mmol/l	1.55 (0.9–2.6)	0.051	1.325 (0.669–2.62)		
<1.7 mmol/l					

*p < 0.05, **p < 0.01 using Chi square test/Binary logistic regression test.
[a] Univariate analysis using Chi square test.
[b] Multivariate analysis using Binary logistic regression.

Table 3
Physical and cognitive function status association with frailty.

Factors	Univariate analysis[a]		Multivariate analysis[b]			
	OR (95%CI)	P value	P value	Exp (B) (95%CI)	P value	Exp(B)
2 min step test						
Steps<45	2.7 (1.48–4.99)	0.000**	0.46	2.04 (1.03–4.14)	0.00**	2.253
Steps>45						
Chair stand test						
Times<8	2.6 (1.3–4.99)	0.002**	0.771	1.12 (0.52–2.4)		
Times>8						
Chair set and reach						
Distance>15.5 cm	2.77 (1.5–5.1)	0.000**	0.016*	2.55 (1.19–5.46)		
Distance<15.5 cm						
Time up and go						
Time>11.5 s	2.6 (1.44–4.7)	0.001**	0.100	1.85 (0.88–3.8)		
Time <11.5sec						
Back scratch test						
Distance >27.2	2.4 (1.3–4.3)	0.002**	0.203	1.59 (0.78–3.24)		
Distance<27.2						
Peak expiratory flow meter						
PEFR<250	2.58 (1.4–4.99)	0.002**	0.022*	2.29 (1.13–4.63)		
PEFR>250						
Shoulder strength						
Strength<5.9	1.46 (0.85–2.47)	0.096	0.767	1.09 (0.60–2.00)		
Strength>5.9						
Rapid pace						
Time>5.2 s	2.72 (1.45–5.12)	0.001**	0.007**	3.24 (1.38–7.60)		
Time<5.2 s						
MMSE						
MMSE<19	1.6 (0.78–3.2)	0.08	0.536	1.27 (0.59–2.75)		
MMSE≥19						
Depression						
GDS >5	1.06 (0.645–1.744)	0.462	0.437	1.27 (0.69–2.32)		
GDS<5						

*p < 0.05, **p < 0.01 using Chi square test/Binary logistic regression test.
[a] Univariate analysis using Chi square test.
[b] Multivariate analysis using Binary logistic regression.

Table 4
Anthropometric measurements association with frailty.

Factors	Univariate analysis[a]		Multivariate analysis[b]			
	OR (95%CI)	P value	P value	Exp (B) (95%CI)	P value	Exp B
Obesity (BMI>30)					0.00**	2.94
Yes	2.07	0.011*	0.288	1.74 (0.63–4.81)		
No	(1.12–3.8)					
Abdominal Obesity						
Yes	1.85	0.005**	0.025*	2.28 (1.1–4.68)		
No	(1.19–2.89)					
Muscle wasting						
MUAC< 23 cm (men)	1.11	0.592	0.990	1.07 (0.09–12.4)		
<22 cm (women)	(0.29–4.23)					
MUAC> 23 cm (men)						
>22 cm (women)						
Muscle wasting						
CC < 30.1 cm (men)	1.02	0.616	0.288	1.726 (0.14–21.3)		
<27.3 cm (women)	(0.32–3.34)					
CC > 30.1 cm (men)						
>27.3 cm (women)						

*p < 0.05, **p < 0.01 using Chi square test/Binary logistic regression test.
Abbreviations: BMI: **B**ody mass index, MUAC: mid upper arm circumference, CC: calf circumference.
[a] Univariate analysis using Chi square test.
[b] Multivariate analysis using Binary logistic regression.

With respect to functional impairment, the slowest percentile of rapid pace gait speed and lowest percentile of peak expiratory flow rate test were significant predictors of frailty, at almost three times higher than the other percentiles. Impairment in physical function was the major domain in frailty definitions, as mooted in many studies[10,26]. The literature reported a decline in peak expiratory flow rate test with aging[27], as peak flow test indicates peak expiratory flow rate (PEFR) and is dependent on respiratory muscular strength. Hence, decreased PEFR can be expected among older adults and this decline was significantly associated with frailty[28]. Moreover, the decline in peak expiratory flow is one of the items used for frailty assessment in the frailty index accumulation of deficit tool[29].

Rapid pace gait speed was also a significant frailty predictor in this study. This finding was expected because lower rapid pace gait speed is highly correlated with slowness, and the latter is one of the

Table 5
Frailty risk factors- Final model.

Factors	B	P value	Exp (B)	CI	Exp(B)	P value
Female gender	0.612	0.028	1.844	(1.07−3.19)	2.602	0.000
Abdominal obesity	0.607	0.032	1.834	(1.05−3.19)		
Low Peak flow	0.984	0.014	2.67	(1.22−5.84)		
Low rapid pace	1.15	0.013	3.17	(1.27−7.89)		

*p < 0.05 using hierarchical binary logistic regression test.

five criteria defining frailty according to Fried et al. (2001)[10]. As mentioned earlier, gait speed is one of the main domains in frailty assessment. Rapid pace gait speed has been reported to be strongly related to frailty[30].

In the present study, abdominal obesity as assessed using the waist-hip ratio (WHR) was a predictor of frailty by almost two times. It is noted that indicators of obesity, including BMI and WHR, were also found to be significant in the univariate model. Traditionally, frailty has been associated with being thin, weak, and undernourished[10]. However, there is strong evidence that excessive adiposity contributes to frailty by reducing the ability of older adults to perform physical activities and by increasing their metabolic instability[31]. In another study of American elderly, obesity was among the frailty predictors for women[32]. In particular, abdominal obesity was associated with frailty status[32,33]. Older adults with obesity normally have poorer physical function[34,35], lower physical activity[36] and are at higher risk of sarcopenia and chronic diseases leading to frailty.

The activity of daily living and the instrumental activity of daily living both showed a significant relationship with frailty. Many studies investigating the relationship between frailty and functional status found that frailty is a predictor of disability[37–39]. However, the present study did not explore this relationship as it focused on frailty as an outcome and not as a disability. Nevertheless, this study has highlighted the prevalence and risk factors of frailty from a wide range of determinants. However, there are a few limitations, including the frailty assessment tools, i.e. Fried's criteria, which uses cut-off points of hand grip and gait speed developed for the Western population. In addition, this study is cross-sectional in design, therefore causal relationships should be interpreted with caution. There is a need to conduct a longitudinal study involving a representative population of Malaysia.

In conclusion, approximately nine percent and sixty percent of older adults in the present study were identified as having frailty and pre-frailty, respectively. Abdominal obesity and poor physical function were the modifiable risk factors of frailty demonstrated among the Malaysian older population.

Conflict of interest

There are no conflicts of interest in this manuscript.

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