BMC Geriatrics

RESEARCH Open Access

Limited health literacy increases the likelihood of cognitive frailty among older adults

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Abstract

Background Cognitive frailty is a dual geriatric syndrome that is preventable with lifestyle changes. Lifestyle changes are influenced by literacy level. However, the association between limited health literacy (HL) and cognitive frailty (CF) is yet to be discovered.

Objectives This study aims to determine the association between HL and CF among older adults.

Methods Data was collected between April 2021 to March 2022 in this cross-sectional study. Citizens aged 60 years and older who can understand Malay and English were selected through purposive sampling from the AGELESS Trial screening sample frame. HLS-M-Q18 was administered to determine HL and CDR, and Fried's Criteria were used to assess the CF status.

Results A total of 757 participants were included in the analysis. 68.2% of the total participants had a limited HL level. The prevalence of CF among older adults with limited HL was 48.2% as compared to those with adequate HL (28.2%) ($p < 0.001$). Based on the HLS-M-Q18 index scores, the robust group had a higher HL index score than those in the CF group: 36.1 (SD = 10.5) and 33.4 (SD = 8.6), respectively, $p < 0.05$. In binary logistic regression, limited HL, increasing age, lower income, lower education level and rural locality were associated with the increase of CF occurrence. Older adults with limited HL have 2.6 times higher odds of having CF.

Conclusion Approximately two-thirds of multiethnic older adults in the study had limited HL, with those with limited HL has 2.6 times higher odds of having CF. These findings emphasize the importance of addressing HL to improve their health outcomes and well-being.

Keywords Health literacy, Cognitive frailty, Older adults, Prevention, Lifestyle intervention

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Introduction

Cognitive frailty (CF) is a state of increased vulnerability to adverse health outcomes from the coexistence of physical frailty and mild cognitive impairment in the absence of dementia or other pre-existing brain disorders [1] An individual with CF has a higher risk of developing dementia and mortality compared to healthy older adults, as well as at higher risk than those with physical frailty or cognitive impairment alone [2–5]. It is noteworthy that CF is a potentially reversible condition, unlike dementia. Studies related to CF among the Malaysian population reported that depression, dependence on daily activities, lack of social support, and low niacin intake were the risk factors influencing the incidence of the disorder [6, 7]. Comprehensive lifestyle modifications and early intervention can be used to reverse or prevent the occurrence of CF in older adults [8]. Therefore, continued research efforts are warranted to understand factors that could influence lifestyle change behaviour among older adults with CF.

Numerous studies have reported a significant association between HL and healthy lifestyle behaviours in older adults. HL is defined as the ability of an individual to seek, understand, and utilize health-related information and required services [9] The World Health Organization (WHO) defines HL as "the cognitive and social skills which determine the motivation and ability of an individual to understand and use information in ways which can promote and maintain good health" [10]. An adequate level of HL will help older adults understand health risk factors and adopt a healthy lifestyle, understand health information and medical instructions easily, evaluate the risks and benefits of treatment wisely and manage health service appointments orderly [11].

The level of HL among older adults is reported to be low [12]; with the prevalence of limited HL in the older adults population worldwide ranging from 27 to 91.5% [13–15]. Older adults often have a greater need for health information and healthcare services because access to these helps them manage their health and the chronic conditions of ageing. Low HL has a significant impact on the population of older adults. It may occur due to physiological and psychological changes and social and cognitive problems [16]. The decline in older adults' cognitive ability could limit their ability to comprehend and recall new topics [17, 18]. Physical impairment, such as hearing and vision loss, may also decrease the ability to process health information [19]. Other than that, psychosocial factors such as socioeconomic status and coping mechanism may negatively affect their understanding of health information [20].

The relationship between HL and CF is underpinned by various theoretical models and empirical research. According to the Cognitive Reserve Theory, individuals with higher levels of education and intellectual engagement demonstrate greater resilience against cognitive decline [21, 22]. HL, defined as the capacity to obtain, comprehend, and utilize health-related information, function as a form of cognitive reserve. Those with higher HL are more adept at managing their health, adhering to medical guidelines, and engaging in health-promoting behaviors, thereby potentially mitigating cognitive decline [21]. Empirical evidence indicates that limited HL is linked to poorer cognitive outcomes. Individuals with limited HL may face challenges in managing medications, accessing appropriate healthcare services, and experiencing heightened stress levels, all of which contribute to cognitive decline [23, 24].

Thus, the current study focuses on Malaysian older adults, a demographic that is rapidly growing. Understanding the specific needs and challenges faced by older Malaysians is crucial for developing targeted interventions that can improve cognitive health outcomes. Given these considerations, this study aimed to address the association between HL and CF among older adults in Malaysia. By identifying key factors that contribute to CF, we can inform public health strategies and healthcare practices to better support the cognitive health of older adults in Malaysia. This study is a part of a Multi-domain Intervention for Reversal of Cognitive Frailty: Towards Personalised Approaches (AGELESS Trial) under the Long Term Research Grant Scheme (LRGS) aimed at developing effective intervention modules for reversing CF for older adults in Malaysia [25].

Methods

Study design

The cross-sectional study employed a purposive sampling method. Data collection was conducted from April 2021 to March 2022 at two different localities, urban (Klang Valley) and rural (Rembau, Negeri Sembilan). A total of 1063 older adults aged 60 and above were screened for CF. Participants were included when they were be able to read or understand either at least Malay or English. While those conditions that may affect participation in information-gathering activities, such as major depression and sensory problems (loss of vision, hearing, or communication ability), were excluded.

Data collection

The screening phase was conducted during COVID-19 movement control order (MCO) period. The screening information was circulated in the form of an e-poster via WhatsApp and social media platforms to recruit participants. Data collection was conducted at various community settings such as community halls, mosques, and senior activity center. Since the screening phase was during the COVID-19 pandemic, strict safety precautions

were followed, such as the use of face masks, frequent hand sanitization and physical distancing. Considering the older adults' difficulties in responding to the self-reported questionnaire, we conducted the survey using face-to-face interviews. Enumerators in this study attended a training series before the data collection to ensure that questionnaires were administered in a standard procedure, difficulties could be handled, and older adults' autonomy and rights were respected. Informed consent was obtained from all participants. To minimize potential bias, we ensured that the assessment stations were set up with adequate distance between them to prevent them from overhearing each other's response. Ethical approval for this study was approved by the UKM Medical Research Committee and the Ethics Committee (UKM 1.21.3/244/NN-2018-156) for the data collection.

Instruments

Sociodemographic

A standardised questionnaire was used to collect details about the older adults' sociodemographic characteristics such as gender, race, religion, education level (years), telephone number, marital status, cohabitation status, and income. A standard ID was assigned to each participant.

Health literacy level survey – Malaysia – questionnaire 18 (HLS-M-Q18)

The assessment of HL status was done using the HL Survey-Malaysia-Questionnaire 18 item (HLS-M-Q18). HLS-M-Q18 has 18 items with three domains (health care, disease prevention, and health promotion) [26]. All items in this instrument were tested for reliability among the older adults with CF in this study. The HLS-M-Q18 showed a satisfactory reliability score, with Cronbach's alpha values of 0.7 and above for all three domains, and the overall instrument achieved 0.89. Each item was scored using a Likert scale with four levels: 1 (Very Difficult) to 4 (Very Easy). The total Likert score of each participant will then be converted into a HL index score with a minimum value of 0 and a maximum value of 50. The HL Index is categorised into Inadequate (<25), Problematic (26-33), Sufficient (34-42) and Excellent (43–50) [26]. In the present study, we have merged the first two categories into 'Limited HL' and the last two categories into 'Adequate HL'.

Cognitive frailty

The operational definition of CF, as proposed by Kelaiditi et al. [1], is based on Fried's Frailty Criteria and CDR to define cognitive impairment status. In our study, participants who were found to be physically pre-frail or physically frail with a CDR score of 0.5 were categorised as pre-CF and CF, respectively. Both pre-CF and CF were grouped under the CF participants group.

Cognitive: Clinical Dementia Rating scale (CDR)

The Clinical Dementia Rating (CDR) was used to obtain information from the potential participant and informant (usually a spouse or adult child) regarding the type and degree of cognitive decline manifested in daily activities at home and in the community [1, 27]. In the CDR, a 5- point scale used to categorise six domain including memory, orientation, problem-solving, community affairs, home activities, and personal care, from which a classification of global dementia staging was obtained. The five CDR classification groups include normal, mild, moderate, severe dementia and early memory deterioration. A score of 0.5 on the CDR is defined as mild cognitive impairment (MCI) [1]. Participants who scored 0 were considered as robust. Whereas, those who scored 1 to 3 (mild to severe dementia) were excluded.

Physical performance

Dominant handgrip strength test Grip strength was measured using a hand dynamometer (Jamar Plus Hand Dynamometer, SI instruments, Pty Ltd, SA, Australia) on the dominant hand to assess upper body strength. The participants were seated in the seated position with elbow flexed at 90 degrees. The handle position was adjusted to fit the participant's hand. Participants were asked to squeeze the dynamometer at maximal effort for two trials, with a 30-second break between each trial [28]. The test of grip strength in older adults has good (intraclass correlation coefficient≥0.85) when using the mean value, the best reading or the first of 2 measures [29]. The higher score was used in the analysis.

Gait speed – 6 m walk test (6MWT) The 6 m Walk Test (6MWT) serves as an assessment for functional mobility and as a predictor for functional decline in the older population [30]. The 6MWT demonstrates exceptional reliability in terms of test-retest consistency (ICC=0.91–0.98) and inter-rater agreement (ICC=0.86–0.96), particularly when administered to frail older adults with cognitive impairment [31]. To administer this test, a 6-meter distance is measured and marked on a level surface, with tape and coloured cones serving as indicators for the starting and ending points. Participants were instructed to walk this distance at their usual walking pace, with time being recorded using a stopwatch from the initiation to the conclusion of the test. Two readings are taken, and the most accurate reading to the nearest 0.1 s is recorded. These readings are then converted to meters per second (m/s).

Frailty indicators

Frailty status was assessed using Fried et al. [32] criteria. It consist of five components: shrinking, which was

not due to diet or exercise (subjective report of unintentional weight loss of 5 kg and above over the last year); weakness was defined by hand grip strength with less than the cut-off points mentioned on the original reference (adjusted for gender and body mass index); exhaustion and poor endurance and energy were indicated by self-reporting of exhaustion, identified by two questions from the CES-Depression scale: (a) I felt that everything I did was an effort and (b) I could not get going (the question was how often in the last week did you feel like this (rare=0, some or little time (1–2 days)=1, moderate (3–4 days)=2, most of the times=3), the participants scored two and above were categorised as frail following the exhaustion criteria; slowness was defined using the five-meter walking time; the cut-off points were adjusted by gender and height; and low physical activity was identified by low scores in the lowest quartile of the physical activity scale for the elderly (Malay version PASE) [33]. Participants who fulfilled none of the criteria were considered as non-frail or robust. Whereas subjects who fulfilled 1 and 2 criteria were classified as pre-frail, subjects with more than three criteria were classified as frail [32].

Data analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 23. Descriptive statistics were used to summarise data, including frequency, percentage, and mean and standard deviation, to describe sociodemographic characteristics of participants and HL scores between the CF and Robust groups. Independent t-tests were used to compare continuous variables between groups, while chi-square tests were employed for categorical variables. For non-parametric data that were not normally distributed, the Mann-Whitney U test was applied. Specifically, the Mann-Whitney U test was used to compare the mean rank of HL domain scores between the CF and robust groups. Binary Logistic Regression analysis was performed to evaluate the odds of CF occurrence in the presence of limited or adequate HL. Statistical significance was set at 0.05.

Results

Participants characteristics

Out of 1063 participants screened, 306 were removed due to incomplete records. A total of 757 participants who completed the questionnaire were included in the final analysis. There were 289 (38.2%) CF and 468 (61.8%) robust participants. The mean age of the participants was 67.5±5.8 years, and 53.7% (n=406) were females. The majority of participants were Malays (86.5%), and 76.8% of participants were from urban areas. A total of 408 (53.9%) participants had at least secondary-level education. The HL Index Score ranged from 0 to 50, and the mean was 35.0±9.9.

Table 1 also shows data on the comparison of variables between CF and robust groups for the total HL index and other sociodemographic characteristics. Based on the HLS-M-Q18 index scores, the robust group had a higher HL index than those in the CF group: 36.1 (SD=10.5) and 33.4(SD=8.6), respectively. This difference was statistically significant (p<0.05). The prevalence of limited HL in older adults with CF was 48.2% as compared to the robust group (28.2%). Based on the independent t-test, there is a statistically significant difference in the mean age between the CF and robust groups. The robust group has a significantly lower mean age (M=66.69, SD=5.1) compared to the CF group (M=68.73, SD=6.5), with a p-value<0.001. Other than that, the groups also have statistically significant differences in household income. The mean difference is 1023.92, in which participants in the robust group have a higher monthly household income than those in the CF group. All significant sociodemographic variables in the bivariate analysis were included in the binary logistic regression to determine the relationship between HL and CF as covariates (Table 2).

The Binary logistic regression analysis findings show older adults with limited HL have 2.6 times higher odds of having CF (r=2.644, p=0.001) compared to those who have adequate HL. Other than that, age, locality, educational level, income, and limited HL have significant associations with the likelihood of CF occurrence in older adults. For each one-unit increase in age, the odds of CF occurrence increase by approximately 4.9% (r=1.045, p=0.004). Living in an urban area (compared to a rural area) decreases the odds of having CF by approximately 65.2% (r=0.328, p=.<0.001). More years of education were significantly associated with lower odds of CF. Each additional year of formal education decreases the odds of having CF by 10.6%. We also found that with one unit increase in income (RM100 or 21.3 USD - set as 1 unit for income variable), the odds of CF occurrence decrease by approximately 1.3% (r=0.986, p=0.019).

We further analysed the HL items based on its domains as presented in Table 3. The mean rank of all HL domains was lower among CF as compared to the robust group (p<0.05). Additionally, the negative Z-scores (-4.369, -3.548, -4.029) suggest that the CF group consistently had lower ranks and lower scores compared to the non-CF group in all three domains. This indicates that individuals with CF tend to have lower HL scores compared to those without CF.

Discussion

This study aims to determine the association between HL and CF. The analysis found that the HL index score was higher in the robust group than in the CF group. Increasing age, rural locality, low education level and limited HL were associated with the occurrence of CF.

Table 1 Association between sociodemographic characteristics and HL with cognitive frailty

Variables	Cognitive Frailty Status			(bivariate)
	Total($N=757$)	CF($n=289$)	Robust ($n=468$)	*p*-value
Age (means (SD)	67.47 (5.8)	68.73 (6.5)	66.69 (5.1)	< 0.001[a]
Age (group)				
60–69 ($n=517$)	517 (68.3)	174(33.7)	343(66.3)	
70–79 ($n=208$)	208 (27.5)	92(44.2)	116 (55.8)	
> 80 ($n=32$)	32 (4.2)	23(71.9)	9(28.1)	
Gender				
Female	350 (46.2)	121 (34.6)	229 (65.4)	0.03[b]
Male	407 (53.8)	168 (41.3)	239 (58.7)	
Race				
Malay	655 (86.5)	241 (36.8)	411(63.2)	0.079
Chinese	61 (8.1)	26 (42.6)	35 (57.4)	
Indian	41 (5.4)	22 (53.7)	19 (46.3)	
Locality				
Urban	582 (76.9)	250 (43.0)	332 (57.0)	< 0.001[b]
Rural	175 (23.1)	39 (22.3)	136 (77.7)	
Marital Status				
Single	31 (4.1)	12 (38.7)	19 (61.3)	.003[b]
Married	489 (64.6)	164 (33.5)	325 (66.5)	
Divorced	38 (5.0)	20 (52.6)	18 (47.4)	
Widowed	199 (26.3)	93 (46.7)	106 (53.3)	
Employment Status				
Working	242 (32.0)	108 (44.6)	134 (55.4)	.013[b]
Not working/ housewife	392 (51.8)	145 (37.0)	247 (63.0)	
Retired	123 (16.2)	36 (29.3)	87 (70.7)	
HL Score	35.0 (9.9)	33.4 (8.6)	36.1 (10.5)	< 0.001[a]
HL Level				
Limited	516 (68.2)	221 (42.8)	295 (57.2)	< 0.001 [b]
Adequate	241 (31.8)	68 (28.2)	173 (71.8)	
Years of education		294.65	431.09	< 0.001[c]
Income (RM)	1817.1(2355.1)	1184.1(1381.2)	2207.9(2720.5)	< 0.001[a]

Presented as n (%) or means with standard deviation (SD).

[a]Significant value at $p<0.05$ using independent t-test.

[b]Significant value at $p<0.05$ using chi-square test of contingencies.

[c]Significant value at $p<0.05$ using Mann-Whitney U test.

In our study, we found that two-thirds of the older adults had limited HL. A previous study reports that more than half (57.6%) of their participants had limited HL [13]. HL in older adults is low as older age is a factor attributed to the decline in physical and cognitive functions that may interfere with their understanding and judgment [34].Chesser et al. [35] from their study concluded that age-related changes contribute to the decline of HL over time, including the decline in cognitive abilities, development of physical impairments such as hearing and vision loss, psychological issues and a sense of embarrassment and shame. From our study, the HL index score for the robust group is 36.1 (SD=10.5). A study conducted among older adults in Malaysia from an urban area reported that the prevalence of limited HL among older adults was 62.6%, with an average HL index of 30.6 (SD=10.0) [36]. Given the variations in the assessment tool and the regions where the participants are being recruited, a relative comparison using this score would not be relevant. However, the findings reflect that older adult in Malaysia generally had limited HL.

Based on the HLS-M-Q18 index scores, there was a significant difference between the CF and robust groups, with the robust group having a higher HL index than those in the CF group. The prevalence of limited HL in older adults with CF was 48.2% in our study. This could be explained by the presence of both physical frailty and mild cognitive impairment (MCI). Older adults with CF will have reductions in cognitive function in terms of processing speed, working memory and reasoning [37–39]. An individual must engage in active problem-solving to successfully navigate a health system, recall doctor instructions, comprehend health information and maintain daily health-promoting behaviour [19].

Table 2 Binary logistic regression analysis for CF with risk factors

Factors	B	S.E	Wald X2	Sig.	Exp(B)	95% C.I.for Exp(B)
Age	0.044	0.015	8.227	0.004*	1.045	1.014–1.077
Gender						
Male						Ref
Female	0.090	0.184	0.236	0.627	1.094	0.762–1.570
Locality						
Rural						Ref
Urban	-1.114	0.216	26.624	< 0.001*	0.328	0.215–0.501
Marital status						
Single			3.043	0.385		Ref
Married	-0.148	0.432	0.117	0.732	0.863	0.370–2.013
Divorced	-0.014	0.206	0.004	0.947	0.986	0.659–1.447
Widowed	0.603	0.383	2.487	0.115	1.828	0.864–3.869
Employment status						
Not working			2.518	0.284		Ref
Retired	0.414	0.265	2.438	0.118	1.513	0.900-2.544
Working	0.289	0.247	1.367	0.242	1.335	0.822–1.169
HL Score	0.016	0.014	1.178	0.278	1.016	0.987–1.045
HL						
Limited						Ref
Adequate	0.972	0.302	10.347	0.001*	2.644	1.462–4.783
Income	-0.014	0.006	5.459	0.019*	0.986	0.975–0.998
Constant	-3.356	1.311	6.559	0.010	0.035	

***significant value, p value < 0.005**

Table 3 Mean Rank of Health Literacy Domain Scores among cognitive Frail (CF) and robust (non-CF) groups

HL Domain	Group (*N*)	Mean Rank	Z score	*P* value
Healthcare	Robust (468)	405.45	-4.369	< 0.001
	CF (289)	336.17		
Disease prevention	Robust (468)	399.94	-3.548	< 0.001
	CF (289)	345.10		
Health Promotion	Robust (468)	403.46	-4.029	< 0.001
	CF (289)	339.38		

A 4 years longitudinal study conducted on Japanese older adults found that limited HL was a determinant of frailty onset and progression [40]. A study conducted by Yamada et al. found that older adults with inadequate HL were disproportionately higher in the pre-frailty (52.2%) and frailty (65.7%) groups than they were in the healthy group (37.6%) [41]. Another study in China reported a significant difference in the HL score between the normal cognitive function group and the MCI group [42]. The association between limited HL and impairment of specific cognitive functions and frailty emphasise the importance of addressing HL in CF management and prevention.

In addition to that, binary logistic regression revealed that limited HL was prevalent in the CF group by 2.6 times. We have also compared the HL score for each domain in the HL questionnaire between the CF and robust groups. Findings show that the CF group has a significantly lower score in all three domains compared to the robust group. Limited HL is associated with an early manifestation of age-related cognitive function decline and may act as an indicator of future adverse outcomes [43]. Other longitudinal studies have also suggested that higher literacy skills at baseline reduce the rate of cognitive decline in older adults, and literacy is consistently more predictive of cognitive decline than years of education [44]. Our results indicate that individuals with adequate HL exhibit better cognitive outcomes and a lower prevalence of CF than those with limited HL, regardless of their years of education. Years of education provide some measure of cognitive reserve; HL comprises the practical ability to understand and manage health-related information, which will also have an impact on cognitive health management and adherence to health practices [22]. This finding shows that limited HL may be an indicator of cognitive function decline; thus, it has clear implications for public policy and interventions that improve HL in older adults.

Regression analysis also showed that older adults from rural areas have a higher odds of CF occurrence compared to those from urban areas. However, from our data, there is no significant mean difference in the HL index between the CF group in urban and rural areas. This can be due to differences in the number of participants between the two groups. A meta-analysis and systematic review found that frailty was more common among rural areas, which may be explained by lower socioeconomic status, limited access to healthcare services, relatively

unhealthy lifestyle and limited healthcare awareness [45]. Older adults with adequate HL are more likely to comprehend and effectively utilize health-related information. This could empower them to make informed decisions about their health, adopt preventive measures and manage chronic conditions better, which could contribute to a lower likelihood of CF.

Our study also found significant associations between CF and HL across all three domains: Healthcare, Disease Prevention, and Health Promotion. Specifically, individuals with CF scored lower in all three domains compared to their robust group. The significant associations identified in our study suggest that improving HL could be a crucial component in managing CF. Healthcare professionals should consider integrating HL interventions into their care plans for older adults, particularly those at risk of or currently experiencing CF.

On the other hand, limited HL may act as a barrier for older adults to seek health services. It can cause communication gaps between older adults and healthcare professionals and may lead to adverse health outcomes for them [46]. For example, such communication barriers have been associated with patients being more likely to be hospitalised or resistant to seeking medical advice for their health needs. Moreover, having an adequate HL level extends beyond the comprehension of health information; it empowers older adults to take control of their health and enhance their overall quality of life. They will have an increased level of self-efficacy, which will help them to be more independent in managing chronic conditions, monitoring medications and adhering to healthy lifestyle choices.

Identifying the risk factor of CF is critical as it can be crucial in prevention and intervention strategies. The findings suggest a need for public policy to improve HL as it can be used as a preventive and intervention strategy for this population. Limited HL may serve as a significant predictor of the risk of CF. In the case of healthcare professionals, it is essential to incorporate HL screening in multidimensional geriatric assessment. A systematic review has suggested that HL intervention can also lead to changes in health behaviours, and there are closer links between HL and behaviour change theories [47]. This could potentially result in interventions of higher quality and greater effectiveness, as lifestyle modifications have proven to be effective in managing CF. Therefore, addressing HL disparities in older adults, especially those with CF, can lead to not only better health outcomes but also more independent and purposeful life in their golden years. This highlights the importance of having targeted interventions and educational programs aimed at enhancing HL among this population which will ultimately contribute to a better quality of life for them.

Effective lifestyle modifications to improve HL among older adults, which in turn may influence CF, should address several aspects. Education and training programs, such as workshops focused on developing HL skills and community education programs that cover preventive health measures, disease management, and the use of technology for health management, can empower older adults to take charge of their health. Additionally, integrating technology by providing training to use digital tools and resources can enhance older adults' ability to seek, understand, and use health information effectively. This includes teaching them how to navigate online health portals, use health apps, and access reliable health information websites. By incorporating these strategies, interventions can be of higher quality and greater effectiveness, leading to improved management of CF through better health literacy.

There were some limitations to our study. First, it was a cross-sectional design; the cause-effect relationship between HL and CF could not be explored further. Second, the findings may not be generalised to the overall CF population in Malaysia because of the heterogeneity among the sociodemographic factors. This would be the first study to assess HL levels among older adults with CF in Malaysia. The findings offer valuable insights into the current association between cognitive frailty (CF) and health literacy (HL), serving as a foundation for more comprehensive longitudinal studies to explore the temporal relationship between HL and CF.

Conclusion

Our results showed that approximately two-thirds of older adults in this study had limited HL; with older adults with limited HL have higher odds of experiencing CF compared to those with adequate HL. These findings emphasise the importance of targeted intervention and strategies to enhance HL in older adults, more so for those with CF to improve their health outcomes and well-being.

Abbreviations

CF	Cognitive Frailty
HLS-M-Q18	Health Literacy Survey Malaysia Questionnaire 18
HL	Health Literacy
LRGS	Long-Term Research Grant Scheme
AGELESS	Multi-domain Intervention for Reversal of Cognitive Frailty: Towards Personalised Approaches (AGELESS Trial)
CDR	Clinical Dementia Rating
6MWT	6 Minute Walk Test
MCI	Mild Cognitive Impairment

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12877-024-05419-x.

Supplementary Material 1

Author contributions
J.M.H performed the data collection, data curation and initial analysis; J.M.H and A.F.M.L further discussed and analysed the data. A.F.M.L verified the method and data validation; J.M.H wrote the original draft; A.F.M.L, D.K.A.S, P.S and S.S provided critical feedback and helped shape the research, analysis, and manuscript. All authors have read and agreed to the published version of the manuscript.

Funding
The Ministry of Higher Education (Malaysia) funds this study under the Long Term Research Grant Scheme (LRGS/1/2019/UM-UKM/1/4)) and approved by the Research Ethics Committee National University of Malaysia (UKM/PPI/111/8/JEP-2020-34).

Data availability
All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Competing interests
The authors declare no competing interests.

Ethics approval
This research approved by approved by the Research Ethics Committee National University of Malaysia (UKM/PPI/111/8/JEP-2020-34).

Consent to participate
Written consent was obtained from all participants before data collection.

Received: 30 October 2023 / Accepted: 30 September 2024
Published online: 15 October 2024

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