Healthy Aging and its Determinants Among Community-dwelling Older Persons in East Coast, Malaysia: A Multidimensional Assessment

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ABSTRACT

Objectives: Exploring the possibility of healthy aging among older persons is crucial for achieving optimal health in the growing older population. This study aimed to determine the prevalence, pattern, and determinants of healthy aging among older persons in Terengganu, Malaysia. *Methods*: We conducted a community-based cross-sectional study involving older persons aged ≥ 60 years. An interviewer-guided questionnaire, anthropometric measurements, and physical assessments were administered to operationalize healthy aging based on a multidimensional concept. *Results:* Among the 765 older persons surveyed, only 14.1% (95% CI: 11.64–16.59) were classified as healthy agers. Multiple logistic regression analysis revealed that superior intrinsic religiosity (odds ratio (OR) = 3.42; 95% CI: 1.34–8.73), higher social interaction (OR = 2.82; 95% CI: 1.32–6.04), larger calf circumference (OR = 2.05; 95% CI: 1.24–3.38), taking water intake ≥ 5 cups per day (OR = 2.01; 95% CI: 1.23–3.30), better gait speed (OR = 1.71; 95% CI: 1.04–2.80), having savings (OR = 1.71; 95% CI: 1.10–2.66), and normal waist circumference (OR = 1.63; 95% CI: 1.04–2.55) were found positively associated with healthy aging. *Conclusions:* Only one in 10 older persons in the state met all the criteria for healthy aging. Specific aspects of religious status, social interaction, socioeconomic, behavioral, physical, and nutritional factors were found to predict healthy ageing in this population. These important determinants should be considered in developing a well-defined and comprehensive public health policy to promote healthy aging in the nation.

The world is experiencing a demographic shift towards an era of population aging, which is one of the five global 'megatrends'.[1] The global aging population is a result of increased life expectancy and declining fertility and mortality rates.[2,3] Malaysia is no exception and has become an aging society,[4] with a forecast to be an aged nation by 2030. Older persons are susceptible to disease and disability,[5] leading to an increased disease burden and greater demand for health services.[6,7] The care for the aged population also produces a great and critical challenge to the family and society at large.[8,9] Consequently, promoting the health and well-being of older persons is of utmost importance to improve their quality of life in their later years.

The prevalence and definitions of successful or healthy aging vary between studies.[10] The concept of healthy aging has evolved from a classic biomedical definition to encompass multidimensional models.

The classical model identifies success aging based on three indicators: being free of illness or disability (and having no risk factors), having high physical and cognitive functioning, and active engagement in social and productive activities.[11,12] However, it has been emphasized that being free of diseases was not the most important component in the concept of healthy aging,[13,14] as age-related chronic diseases can coexist with healthy aging.[15–17] Many older individuals have well-controlled health conditions that do not impair their ability to function, highlighting that healthy aging does not mean 'without disease'.[18,19] Several domains have been considered to define healthy aging, including major diseases,[20–23] physical, cognitive, and emotional functions and social or productive engagement.[21,24,25]

Numerous variables have been studied as predictors of successful or healthy aging, including demographic factors such as age, gender, educational level, and marital status,[26–28] behavioral factors like

physical activity,[28,29] smoking status,[30] and dietary habits,[31] economic factors such as income,[21,32] and social factors including social connectedness, community activity, religious activity,[33] strong religious belief,[34] independence,[35] positive self-perception of health,[36] and life satisfaction.[37] As healthy aging may be influenced by cultural background, age, and gender, it is essential to examine factors specific to the local cultural and social context.[38]

This study aimed to fill the gap in the literature by determining the prevalence and determinants of healthy aging using a multidimensional construct among older persons who may not be completely free of disease. A consensus on concise indicators for a universal healthy aging concept and its factors is crucial for non-western countries like Malaysia.

METHODS

A cross-sectional survey was conducted among 765 Malaysian community-dwelling older persons aged ≥ 60 years, both with and without comorbidities. However, those who were dependent, such as severely frail older persons, those with severe cognitive impairment, mental disabilities, severe sensory impairment, and bedridden individuals, were excluded. Older persons living in institutions were also excluded. A two-stage cluster random sampling method was used, where all eight districts in the state were initially chosen, and then a sub-district was randomly selected from each district. Finally, all individuals who met the inclusion and exclusion criteria in each selected sub-district and were available during the data collection period were included in the study.

The sample size was calculated using the single proportion formula,[39] considering the nearest estimation proportion of healthy older persons in Malaysia[24] and two proportion formulas using the Power and Sample Size Calculation 3.1 software, taking into account variables that were documented as significant determinants with available reference parameters in the literature, such as physical activity.[40] The final calculated sample size was 765 based on the latter objective, considering the cluster effect.

Health programs involving community-dwelling older persons were conducted in the selected sub-districts between October 2019 and February 2020 to gather data. Participants who consented to participate in this study underwent screening for mood and cognitive status, followed by an interview, anthropometric measurements, and physical assessment. The interviewer-guided session was conducted using a standardized questionnaire by trained enumerators. Participants' comorbidities and chronic illnesses were self-reported and verified with either their relatives and/or medical cards.

The tools used in this study included questionnaires, anthropometric measurements, and physical assessments. The first section of the questionnaire covered explanatory variables, including sociodemographic characteristics, economic characteristics, physical and social living support, and behavioral status. The nutritional status was assessed by Mini Nutritional Assessment®,[41,42] religious status was obtained using the Duke University Religion Index,[43] and social status was obtained by nine items on social and community involvement.

The second section of the questionnaire assessed the dependent variable, healthy aging status. Healthy aging was operationalized based on the multidimensional criteria set by previous scholars.[11,14] Participants were classified as healthy agers (HAs) and usual agers. HAs were those who fulfilled all five criteria: 1) presence of optimal health of common comorbidities such as controlled and stable hypertension, diabetes, heart disease, stroke, cancer, and chronic lung disease; 2) satisfactory physical functioning; 3) satisfactory cognitive functioning; 4) no depression; and 5) satisfactory social functioning. Usual agers refer to participants who met less than five criteria. They represented older persons with common or ordinary status or having typical physical, emotional, cognitive, and social functioning. Table 1 describes the tools and criteria of healthy aging.

All these tools in the Malay version were pre-tested and validated by previous researchers. Additionally, nine items on social function and community involvement, which consists of membership, activity involvement, and social interaction, were newly developed and validated. The nutritional and physical status of the participants, including waist circumference, calf circumference, gait speed, and handgrip strength, were also obtained. Anthropometric measurements and physical assessments were carried out by trained researchers and personnel using standardized protocols.

Table 1: Description of healthy aging criteria.

Domain	Optimal health	Physical function	Mood status	Cognitive function	Social function
Tool and indicator	a. Mean systolic blood pressure < 140 mmHg and mean diastolic blood pressure < 90 mmHg. b. Fasting capillary glucose level of ≤ 7.0 mmol/L or postprandial ≤ 8.5 mmol/L. c. No self-reported compromised functions due to underlying chronic diseases* and its complications.	Malay Katz ADL with score of 5–6,[44] and Lawton Instrumental ADL with a score of 5 in men or 8 in women.[45]	Malay Geriatric Depression Scale of < 5.[46]	Malay Elderly Cognitive Assessment Questionnaire score of ≥ 44.[47,48]	Medical Outcome Study Social Support Survey score of ≥ 62.[49]
Criteria**	Controlled comorbidities' status.	Satisfactory physical function in ADL.	No depression.	No cognitive disability.	Satisfactory social function.

*Six major diseases include hypertension, diabetes, heart disease, stroke, cancer, and chronic lung disease. **Healthy agers: fulfil five criteria; usual agers: fulfil one, two, three, or four criteria only
ADL: Activities of Daily Living..

All analyses were carried out using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Descriptive statistics were used to describe the sociodemographics of the participants. Percentage and 95% CIs were used to estimate the prevalence of HAs. Determinants for healthy aging status were initially screened using simple logistic regression with a significance value set at $p < 0.25$ and later multivariable logistic regression with a significance set at $p < 0.05$.

A total of 41 independent variables under eight factors, including demographic (age, gender, educational level, marital status, employment status, etc.), economic (income, number of children, savings, property ownership, etc.), behavioral (diet consumption of protein, fruits and vegetable consumption, daily water intake, smoking habit, sleep duration, indoor activity and leisure activity, etc.), nutritional (body mass index (BMI), calf circumference, waist circumference, etc.) and physical status (handgrip strength and walking speed), social (living arrangement, pet ownership, status of caregiver during ill, own bedroom, etc.) and physical living support (use of cell phone, use of computer, use of information and communication technology application, and safety living environment), and religiosity (organizational religious activity, nonorganizational religious activity, and intrinsic religiosity) were tested as candidate predictors of healthy aging.
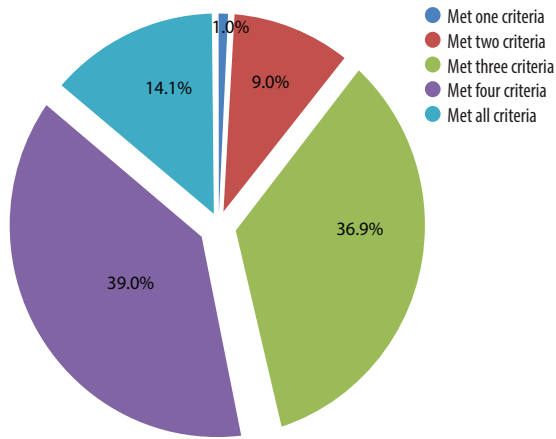
Approval to conduct this study was obtained from the Terengganu State Government i.e., Institut Modal Insan Terengganu Sejahtera (i-MiTS. TR.450/10/2-99) and the Human Ethics Committee of UniSZA.C/2/UHREC/628-2 Jld 2.11.

RESULTS

A total of 765 respondents were included in the final data analysis, resulting in a 100% response rate. Among the overall sample, there were significantly more female respondents (64.1%) than males. The participants' ages ranged from 60 to 88 years, with a mean age of 67.7±5.8 years. The largest proportion of respondents (41.7%) belonged to the young-old age group (60–64 years), while only 0.3% were in the oldest-old group (≥ 85 years).

Based on the adopted criteria and measures, 14.1% (95% CI: 11.64–16.59) of the respondents were classified as HAs. About 39.0%, 36.9%, and 9.0% met four, three, and two out of five healthy aging criteria, respectively [Figure 1]. Only 1.0% of the participants met one criterion of healthy aging. The prevalence of healthy aging status and corresponding percentages based on the criteria of healthy aging are presented in Table 2.

Around a quarter (31.4%; 95% CI: 28.08–34.67) of the respondents reported optimal health for six common major diseases. Among the six major diseases, 31.4% of the respondents had one disease, 31.0% had two to three diseases, and 0.5%

Figure 1: Distribution of participants who meet the criteria of healthy aging.

Table 2: Prevalence of healthy aging according to its multidimensional criteria (N = 765).

Healthy aging criteria	n (%)	95% CI
Presence of optimal health of common comorbidities	240 (31.4)	28.08–34.67
Satisfactory physical functioning	548 (71.6)	68.43–74.84
Good mood status	684 (89.4)	87.23–91.60
Satisfactory cognitive functioning	765 (100)	100.00–100.00
Well social functioning	500 (65.4)	61.98–68.74
Healthy aging status using all criteria		
Healthy agers (fulfil all five criteria)	108 (14.1)	11.64–16.59
Usual agers (fulfil less than five criteria)	657 (85.9)	-

had more than three diseases. The most prevalent major chronic diseases were uncontrolled high blood pressure (55.4%) and uncontrolled diabetes mellitus (31.6%), whilst 0.3% were suffering from cancer. A high percentage of respondents (89.4%; 95% CI: 87.23–91.60) met the criteria for good mood status and satisfactory physical functioning (71.6%; 95% CI: 68.43–74.84). All respondents reported satisfactory cognitive functioning (100%). Nearly two-thirds (65.4%; 95% CI: 61.98–68.74) of them met the criteria for social functioning.

Variables were screened using simple logistic regression to identify potential predictors, and 20 out of 41 variables were statistically significant and identified in the univariable analysis, with a *p*-value < 0.25.[50] The significant variables included sociodemographic characteristics (gender and marital status), socioeconomic factors (number of children and savings), physical living support characteristics (use of cell phone and information and communication technology application), religiosity (organizational religious activity, non-organization/private religious activities, and intrinsic religiosity), membership and social interaction, behavioral characteristic (daily water intake, protein intake, daily indoor activity, recreational leisure activity, and sleep duration), nutritional status (BMI, waist circumference, and calf circumference), and physical status (gait speed). These significant variables were then analyzed using multivariable logistic regression analysis.

Initially, the forward logistic regression yielded eight significant potential predictive variables.

However, in the backward elimination model, a total of seven out of eight predictor variables were found to be statistically significant, excluding BMI. The significant variables for predicting healthy aging status were savings, water intake, calf circumference, waist circumference, gait speed, social interaction, and intrinsic religiosity [Table 3].

The model fit was reasonable, and model assumptions were met. There were no significant interactions, multicollinearity problems, or outliers detected.

DISCUSSION

As the world's population ages, the importance of healthy aging research is growing, and healthy aging has become a prominent theme globally. The term 'healthy aging' is often used interchangeably with concepts such as 'active', 'successful', and 'productive' aging. Unlike 'successful aging' or 'anti-aging' discourses, which focus on the prevention of disease or slowing the aging process, healthy aging emphasizes preserving physical and cognitive function despite the presence of health problems.[51,52] It has been highlighted that applying multidimensional criteria to identify the older aging population in a better condition could be more informative than focusing on unidimensional health outcomes.[53] To the best of our knowledge, this study is pioneering in considering the presence of major diseases with optimal health to be qualified as healthy aging, while others excluded them[54–57] or included them based on the number of major diseases they

Table 3: Associated factors for healthy aging status using multiple logistic regression (N = 765).

Variables	Crude OR (95% CI)*	Adjusted OR* (95% CIb)**	Wald statistics (df)	p-value
Savings				
No	1.69 (1.10–2.58)	1.71 (1.10–2.66)	5.561 (1)	0.018
Yes				
Water intake, cups/day				
< 5	1.78 (1.11–2.86)	2.01 (1.23–3.30)	7.671 (1)	0.006
≥ 5				
Calf circumference				
At risk	1.80 (1.16–2.79)	2.05 (1.24–3.38)	7.875 (1)	0.005
Not at risk				
Waist circumference, cm				
At risk	1.77 (1.17–2.68)	1.63 (1.04–2.55)	4.599 (1)	0.032
Not at risk				
Gait speed				
At risk	1.66 (1.04–2.64)	1.71 (1.04–2.80)	4.531 (1)	0.033
Not at risk				
Social interaction				
Unsatisfactory	3.00 (1.42–6.31)	2.82 (1.32–6.04)	7.107 (1)	0.008
Satisfactory				
Intrinsic religiosity				
Unsatisfactory	3.57 (1.42–8.98)	3.42 (1.34–8.73)	6.569 (1)	0.010
Satisfactory				

*Simple logistic regression; **multiple logistic regression.
Odds ratio; df: degree of freedom.

have suffered.[21,58] The current strategy tried to move away from highlighting multimorbidity but focused on how elders function in their surroundings while managing their illnesses.

The prevalence of healthy aging among community-dwelling elderly in Terengganu (14.1%) is comparable to successful aging rates among elderly individuals in Norway (14.5%)[54] but slightly higher than rates reported among older Koreans (13.3%)[21] and Americans (11.9%).[22] However, it is lower than the rates reported among older Singaporeans (25.4–28.6%).[23,59] Other local studies that also applied multidimensional criteria for successful aging reported healthy aging prevalence at 11% and 13.8%, respectively.[24,57] Likewise, the results of this study seemed to be higher than older Nigerian (7.5%),[60] Taiwanese (10.4%),[61] Iranian (11.2%),[62] and Dutch older persons (10.0%)[63] that employed criteria that were more subjective and focused on psychosocial aspects.

It was discovered that substantial variability in successful and healthy aging prevalence has been reported mostly depending on the criteria/ indicator used to define healthy aging. Most studies using restrictive criteria excluding major diseases as indicators for identifying healthy aging status have shown a lower prevalence.[21,24,54,57] The result seems possible due to the multidimensional criteria applied to describe the healthy aging status.[64,65] Another possible explanation for the low prevalence of healthy aging findings is that it seems commensurate with the fact that the prevalence of disease and disability is higher among older persons, as the majority (62.9%) of the participants suffered from at least one chronic disease. Additionally, there may be a discrepancy due to the different responses of the study population based on their cultures and value systems of what constitutes healthy aging.[17]

In the absence of a single gold standard for the measurement of healthy aging, this study has constructed a solid assessment comprising multidimensional criteria, namely physical, including health diseases and activities of daily living, mood status, and cognitive and social components as evidenced by the previous researchers[11,14,24] for defining an accurate healthy aging status in this

study. A multidimensional concept applied to define healthy aging in the present study is consistent with the World Health Organization's definition of healthy aging as "the process of promoting and maintaining functional capacity that allows well-being in old age".[19] Functional ability refers to having the mental and physical capacities that allow older persons to function (i.e., meet basic needs, make a decision, build and maintain relationships, and make contributions).[19,66]

Intrinsic religiosity was found to be the most significant factor associated with healthy aging status. The positive impact of spirituality and religiosity on well-being and coping with chronic diseases has been supported by previous studies.[67,68] The strong religiosity observed among the Muslim participants in this study may contribute to their positive thinking and resilience in dealing with illnesses.[69,70] The Muslim respondents considered illness, suffering, pain, and death as tests from God and regarded illness as a means of expunging one's sins.[71]

Furthermore, the participants in this study with satisfactory social contact were found to be healthier as compared to their counterparts. Older persons who have continuous interaction with others will have more positive health indices associated with healthy aging[72] as well as enhanced level of health-related quality of life.[73,74] In addition, our study revealed that savings were significantly associated with healthy aging status. It was found that financial issues can affect older persons' mental health and become a significant source of stress for many older persons.[75,76] Furthermore, financial constraints have a significant impact on psychological health and well-being and may contribute to poor nutrition, mobility, functional status, and cognitive status.[77,78] The importance of financial security in later life is underscored by the fact that older persons are more susceptible to morbidities, with some having neither a pension nor passive income. Older persons with more financial resources can access better preventive and tertiary healthcare.[79,80]

Besides, a positive and significant relationship between gait speed and healthy aging status signified that older persons who are physically competent have a better chance of being healthy than their at-risk counterparts. Older persons with delayed gait speed are at risk for physical frailty. Walking and physical activity are highly promoted among older persons as they are positively associated with good physical and functional well-being, as well as enhanced mood, better mental health, and proprioception preservation.[81–84] In addition, gait speed has been proven reliable and sensitive in detecting frailty status and sarcopenia.[85,86]

Calf circumference was highly associated with nutrition status, diagnoses of sarcopenia, and frailty.[87–89] The present results found that older persons who are not at risk for malnutrition have a better chance of being healthy than their at-risk counterparts. It reinforced research findings that a smaller calf circumference is linked to poor physical function, while a larger calf circumference was associated with better skeletal muscle mass, physical performance, and strength.[90–93] Muscle mass plays a big role in musculoskeletal strength and mobility in maintaining independence in older age.[94,95]

Consistent with other studies, our study found a positive relationship between normal waist circumference and healthy aging status.[96,97] The result supported other studies that discovered waist circumference was an accurate method for predicting general health, and those with abdominal obesity are more likely to score lower healthy aging score.[97,98] The elderly with high waist circumference or obesity were more likely to suffer multimorbidity, cardiovascular diseases, chronic diseases such as diabetes, osteoporosis, arthritis, and mortality.[99–103] Hence, it can be concluded that both nutritional indicators (normal calf and waist circumference) were positively associated with healthy aging status.

Fluid intake is rarely considered in the evaluation of dietary intake, even though it is a critical component of optimal metabolic function and nutritional status.[104] There has been minimal research addressed fluid intake among older persons, and most studies are focused on adolescents or children and adults.[105,106] To our knowledge, no other studies have included measures on water intake towards healthy aging, thus, limiting comparisons across populations. This study acknowledges the importance of daily fluid consumption for the elderly. Adequate hydration ensures the appropriate function of the kidneys, brain, and mood.[107–109]

The main strength of this study is the multidimensional criteria used to define healthy aging, which offers a holistic approach to healthy aging. Furthermore, the predictors associated with healthy aging revealed include components such as

water intake, savings, and intrinsic religiosity, which have not previously been addressed. The existing local studies have included retrospective data from a national survey and a longitudinal study,[23,56] while our study used a community-based cross-sectional study to determine the prevalence and associated factors of healthy aging. This study adds valuable data on participants in Terengganu, mainly for community settings. Additionally, the large study sample and the recruitment of participants from eight districts within one locality contribute to a better representation of the population and perhaps provide more accurate results.

However, this study has some limitations. It excluded fragility from the concept of healthy aging assessment, focusing on optimizing health and independence among older persons, and almost all successful or healthy aging studies exclude frailty status in their criteria. Frailty is a condition that impairs older persons' functioning, where they presented with low grip strength, low walking speed, low level of physical activity, self-reported exhaustion, and unintentional weight loss.[110–114] It is characterized by loss of muscle mass, reduced functional capacities, and increased vulnerability to stressors.[112,115]

In addition to health aspects, the major aspects of social, religious, economic, behavioral, physical, and nutritional status were found to be the most significant in determining the health status of older persons. The healthy aging policy should consider a wider multidimensional health outcome approach to optimize opportunities for older people's health, social participation, and security.

Strengthening existing prevention initiatives for older persons is vital to support successful, healthy, and active aging. Health promotions on active lifestyles are highly recommended, especially during the International Day of Older Persons celebration on the first of October each year to honor the nation's elders.

It is suggested that policies and rules for retirement, continued paid work, pensions, and other income to support older age be considered. Malaysian policymakers and authorities should consider active aging policies that employ older persons into the workforce because this group has significant experience and expertise and can contribute ideas and guidance for future generations.[116] Policy to support older adults to remain in the workforce, specifically with reduced working hours, part-time work, job-sharing, and working from home, can benefit from flexible working practices.

CONCLUSION

Our study emphasizes the importance of a multidimensional approach to healthy aging. Older persons with strong intrinsic religiosity, active social lives, good nutritional status, adequate water intake, physical competence, financial security, and healthy weight were more likely to age healthily. The findings can guide healthcare providers in supporting Malaysian older persons to adapt positively to the challenges of old age. Policymakers should consider active aging policies that involve older persons in the workforce to utilize their experience and expertise for the benefit of future generations. Future studies should replicate and expand on this research to develop a more comprehensive understanding of healthy aging and design effective intervention programs in health and social services.

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