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Original Article

Validation and Development of a Malnutrition Screening Micro-Questionnaire Among Community-Based Older Adults

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Abstract

Introduction: Our primary objective was to evaluate the psychometric properties of Mini nutritional screening assessment (MINI-MNA) among our community-dwelling older adults. Our secondary objective was to put together a micro-version with superior psychometric properties and empirical probable cut-point value for screening malnutrition risk.

Methods: We recruited elderly (60⁺years) subjects (10 subjects/questionnaire-item) from various sampling units in the general urban population of Gorgan district, Golestan. The questionnaire was translated and back-translated to, in turn, determine various psychometric properties. We also did exploratory and confirmatory factor analyses. Data analyses were conducted using AMOS (Analysis of Moment Structure) and SPSS Statistics version 25 (IBM Corp, Armonk, NY).

Results: A total of 242 subjects ((54.1% men; sample mean age 70.5 (95%CI 69.5-71.5) years) successfully participated. For MINI-MNA, the alpha coefficient was 0.75 and the average item-test correlation was 0.67. Its group alpha coefficient for responding a *yes* or *no* to its item(s) was 0.78 and 0.82, respectively. Its fit index was 0.95. For our micro-questionnaire, the alpha coefficient was 0.81 and average item-test correlation was 0.81. Its fit index was 0.97. It's probable age-adjusted cut-point for distinguishing the risk of malnutrition was a score six with a sensitivity of 92.3%, specificity of 94.8% and a Youden index of 0.87.

Conclusion: Our questionnaire displayed far better psychometric properties as compared to MINI-MNA. We acknowledge that this questionnaire is not intended to be a replacement of existing questionnaires, a brief, optimized alternative helps address barriers like limited visit time, patient/provider burden, and lower sensitivity/specificity found for some tools in prior research but rather expands on the ways to screen the risk of malnutrition among community-based older adults.

Keywords: Aged, Epidemiology, Malnutrition, Nutrition assessment

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Introduction

The population in many countries is considered to be rapidly aging.[1-3] This rapid aging means that with an increasing older population, there would also be a simultaneous increase in age-related bodily, mental and social changes.[1]. These changes may include or may lead to the development of malnutrition among older adults. Malnutrition is both over- and under-nutrition and includes measurable adverse effects on body composition, function or clinical outcomes. Besides enormous public health significance, malnutrition is an important clinical parameter and a predictor of poor outcomes among older adults.[4]

The majority of those affected with malnutrition are located in the community.[5] This is a setting where, despite policy recommendations,[6] adequate awareness, screening, and staff training on malnutrition remains mostly unmet. Others have also shown that many treating physicians do not actively evaluate older adults for malnutrition,[7] All other authors have no conflicts of interest. and tend to rely on quick clinical decision[8] instead of making an objective

assessment.[9,10] Thus, community-based older adults appear to struggle with probable malnutrition and poor outcomes that may arise from it, as well as a risk of inadequate evaluation of their probable malnutrition.

Although there might be a number of evaluation tools on malnutrition,[11] their use among older adults is supported by little evidence,[12] and none of them proves to be most effective.[13] Moreover, given the nature of study setting, population characteristics, and research study methodologies,[14] the properties and practical utility of malnutrition tools may differ.[15] Not having adequate tools for malnutrition for older adults is unfortunate. This is so because, with timely and proper detection, the management against malnutrition may initiate, which can help to shorten the suffering for older adults and improve their quality of life and social impairment in the long-term.[16] Others have also shown that a shortage of disease detection tools is one of the barriers for morbidities to remain undetected or underdiagnosed.[14]

Thus, with such a vision, our primary objective was to adjudge the psychometric properties of an existing Mini Nutritional screening Assessment (MINI-MNA) among community-dwelling older adults (aged at least 60 years) in Gorgan (Golestan). Our secondary objective was to put together a micro-version with superior psychometric properties and empirical probable cut-point value for the risk of malnutrition. Shorter tools are more useful in clinical settings where detailed evaluations are not always viable or preferable.[17] Therefore, through this study, we provide the prospects of a valid shorter evaluation of malnutrition for older adults to help expand the "strategy of screening" to everyday clinical practice.[8]

Methods

We used three pertinent sampling units nested in the general population of Gorgan district (Golestan province) to recruit our participants. These units included the main central park, elder leisure center, and the main central mosque. In every district of our country, the national government has established one central park, one central mosque and one elder leisure center. Our study was conducted over a 6-month period from August 2016 to January 2017. Participants were recruited and data collected during this time frame. The criteria for inclusion in this study was 1- Adults aged 60 years and older; 2- Living independently in the community; 3-Ability to independently participate in interviews and measurements. The exclusion criteria were including: 1- Diagnosed neurocognitive conditions like dementia that could impair consent and participation; 2- Active cancer treatment in the past 3 months; 3-Hospital admission in the previous month for an acute illness; 4-Terminally ill patients under palliative end-of-life care; 5-Bedridden patients unable to undertake interview and measurements; 6-Wheelchair-bound patients due to chronic disabling conditions. At all exit points of our sampling units concurrently, after a random first contact, the field staff approached every third individual from there for participation in the study. This procedure continued until we reached the desired number of participants, i.e. ten individuals per questionnaire item. The ethical approval obtained from university of social welfare and rehabilitation sciences, Tehran, Iran (IR.USWR.REC.1395.126).

For validation studies, there are no exact recommendations for sample size, which varies from two to 20 individuals per questionnaire item[18] with an absolute minimum of 100 subjects.[19,20] Other suggestions imply that while up to 100 participants is a poor sample size, anything increased by a fraction of 100 is respectively considered as a fair, good, and excellent sample size for validation studies.[19,20] For studies with factor analysis, the recommended sample size varies from three to ten subjects per questionnaire item.[19]

Of all screening tools available for malnutrition, we chose MINI-MNA because it is considered to be one of the widely used tools around the world.[21] The authors obtained permission from the developers of the original MINI-MNA questionnaire to translate and use it in this study. As recommended,[22] an expert panel of 5 trained specialist members (nutrition, mental health, neurology, Public health, Gerontology) with a fluency in English was constituted. Following that, an English language MINI-MNA was translated into Persian. After that, panel discussions took place until there was a complete consensus on the translated version. After that, the Persian version was back-translated into English by an external professional translator who was fluent in Persian and medical terminology. After that, both versions were evaluated side-by-side by the same panel, who discussed items on the basis of feasibility, readability, consistency of style and format, and clarity of language.[23] Panel responses were used to improve the items.

A preliminary pilot testing was conducted on a small sample of 30 intended older adults recruited from the same source units,[24] who were later not included in the final sample. After the completion of the translated questionnaire, the respondents were asked to elaborate on what they thought about each questionnaire item and what their corresponding response meant to them. This approach allowed us to make sure that the translated questionnaire retained the same meaning as the original, while also ensure that no confusion remains regarding the translated version.

Each participant underwent a physical examination spanning the measurement of weight and height. Weight was recorded to the nearest 0·1 kg, with the subject in light clothes and barefoot, using a three-lever scale calibrated with 1 kg and 5 kg standard weights after each measurement. Height was recorded to the nearest 0·1 cm using a flexible inextensible tape, with the subject's bare feet close together, back and heels against the wall, standing erect and looking straight ahead. Body Mass

Index was calculated as body weight in kilograms divided by the square of height in meters. All interviews and anthropometric measurements were performed by trained nutritionists. Criterion-related validity was done to check whether the instrument correlates with another criterion in the same area. For this, Spearman's rank correlation coefficients between questionnaire scores and the criteria of BMI were calculated.

We estimated the alpha coefficient for the entire MINI-MNA questionnaire. After that, those items that had a low, i.e. ≤ 0.70 item-test correlation[25] were excluded to derive a revised version (*re-branded* here for the sole purpose of better clarity and differentiation as 4-item Bhalla Elder Malnutrition Micro questionnaire, MICRO-4). For factor analysis, we conducted exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) that included measures of fit index, standardized residual size, and coefficient of determination. For EFA, we used the standard criteria, including eigenvalue ≥ 1.0 and factor loading ≥ 0.40. Kaiser-Meyer-Olkin (KMO) test was done to determine sampling adequacy. Bartlett's test of sphericity was also done. Besides this, all participants underwent cognitive appraisal with the Abbreviated Mental Test (AMT), which has high psychometric parameters among older adults.[26]

We determined the probable cut-point of MICRO-4 vis-à-vis MINI-MNA for the risk of malnutrition by using logit command and maximizing the Youden index measure. Sensitivity and specificity were determined for our cut-point value. Lastly, we obtained ethics permission from the Institutional Review Board of the University of Social Welfare and Rehabilitation Sciences. We requested all individuals to provide their informed written consent before volunteering.

Results

In total, we approached 250 subjects; of which 242 subjects (≥ 60 years of age) successfully participated. Their mean age was 70.5 (95%CI 69.5-71.5) years (Table 1). Of our entire participants, 131 were men (54.1%), and 111 (45.9%) were women, $P = 0.1$. A total of 54 (23.2%) subjects were illiterate and 42 (17.8%) subjects were living alone.

Table 1. Demographic Characteristics of the Participants (N = 242)

Characteristic	Value
Age (years)	Mean: 70.5 (95% CI: 69.5–71.5)
Gender	
Male	131 (54.1%)
Female	111 (45.9%)
Literacy Level	
Illiterate	54 (23.2%)
Literate	188 (76.8%)
Living Arrangement	
Living Alone	42 (17.8%)
Living with Family/Others	200 (82.2%)

Reliability: Cronbach's alpha, item-test correlations

Based on an existing MINI-MNA questionnaire, the average score of our entire sample was 10.5 (95%CI 10.0-11.0), which was 10.4 (95%CI 9.7-11.1) for men and 10.8 (95%CI 9.9-11.7) for women, respectively, $P = 0.2$. Coming to the psychometric properties of this questionnaire, the MICRO-4 demonstrated superior internal consistency compared to the MINI-MNA, with a Cronbach's alpha of 0.81 versus 0.75, reflecting an 8% improvement. The structure matrix of MINI-MNA showed a fit index of 0.95, the size of residual of 0.04 and a cumulative variance of 87.0%. The KMO was 0.80 and Bartlett's test was statistically significant ($x^2 = 299.3$, $P < 0.001$).

Also, for MICRO-4 questionnaire, the group alpha coefficient for responding a *yes* and *no* to an item also improved as 0.88 (from 0.78 of MINI-MNA, as in previous para above, a change of 13.0%) and 0.92 (from 0.82 of MINI-MNA, as in previous para above, a change of 12.2%), respectively. Also, for MICRO-4, the percent group difference between alpha coefficients of responding a yes (0.88) or no (0.92) to an item was 4.4%, which was 5.0% for MINI-MNA as in the paragraphs above.

Validity: Factor structure (EFA/CFA), criterion validity (BMI correlation)

The result of Exploratory Factor Analysis (EFA) indicated that the MICRO-4 demonstrated a unidimensional structure with a cumulative variance of 88.0%, compared to the MINI-MNA's multi-factor structure (cumulative variance = 87.0%). The results of Confirmatory Factor Analysis (CFA) showed that the MICRO-4 had a superior fit index (0.97) and smaller residual size (0.03) compared to the MINI-MNA (fit index = 0.95, residual size = 0.04), indicating a more robust model (Table 2).

Factor Loadings (MICRO-4): All four retained items demonstrated strong factor loadings, ranging from 0.79 to 0.86, supporting the unidimensional structure of the MICRO-4.

The correlation between questionnaire scores and BMI was stronger for MICRO-4 (0.82, $P < 0.001$) compared to MINI-MNA (0.73, $P < 0.001$), indicating superior criterion validity for the revised tool.

Diagnostic Accuracy: Sensitivity, specificity, Youden index, ROC curve

We determined the probable age-adjusted diagnostic distinguishing cut-point for our MICRO-4 questionnaire vis-à-vis MINI-MNA malnutrition screening questionnaire. We found that an age-adjusted cut-point for distinguishing probable risk of malnutrition was a score six with a sensitivity of 92.3% and a specificity of 94.8% and a youden index of 0.87.

The Figure 1 indicates that the Persian Short-Length

Table 2. Psychometric Properties of MINI-MNA and MICRO-4

Psychometric Property	MINI-MNA	MICRO-4
Cronbach's Alpha	0.75	0.81
Average Item-Test Correlation	0.67	0.81
Group Alpha Coefficient		
Yes	0.78	0.88
No	0.82	0.92
Group Difference (%)	5.0%	4.4%
Fit Index (CFA[&])	0.95	0.97
Residual Size	0.04	0.03
Cumulative Variance (%)	87.0%	88.0%
Criterion Validity (with BMI[*])	0.73 ($p<0.001$)	0.82 ($p<0.001$)
Sensitivity	Not applicable	92.3%
Specificity	Not applicable	94.8%
Youden Index	Not applicable	0.87

[*]Body Mass Index; [&] Confirmatory Factor Analysis By extracting those items from MINI-MNA that had their item-test correlation at least 0.70, four items got retained numbered one, three, four and six. As a result, the alpha coefficient of this MICRO-4 questionnaire became 0.81, i.e., a change of 8.0% from the alpha coefficient of 0.75 for MINI-MNA. Also, the average item-test correlation became 0.81 for this MICRO-4 questionnaire, i.e., a change of 20.8% from the average item-test correlation of 0.67 for MINI-MNA, as in the previous para above.

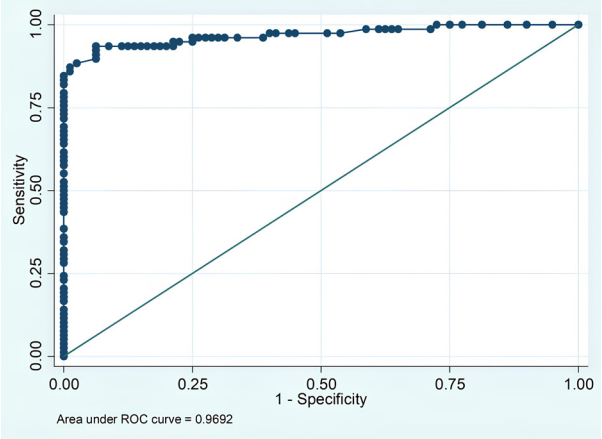

Figure 1. Screen plot showing the one-factor structural matrix of a Persian Short-Length Mini Nutrition Assessment questionnaire

Mini Nutrition Assessment questionnaire demonstrated excellent discriminative capability, as evidenced by an AUC of 0.969. This value indicates that there is a 96.9% chance that the questionnaire will correctly differentiate between individuals at nutritional risk and those not at risk. Coupled with a scree plot that confirms a robust one-factor structure, these findings suggest that the instrument is both structurally valid and highly effective for screening purposes in diverse population settings.

Discussion

The methodology of our study was reasonably robust. For example, our sample was derived from among the community-dwelling residents nested in the general population pool. The focus of this study was rightly on older adults, given their disproportionate risk of malnutrition as well as inadequate appraisal of malnutrition tools among them.[5,6] We also had a balanced representation of men and women in our sample ($p=0.2$). The size of our recruited sample was in line with the general recommendations about validation studies. Furthermore, there are about 110 million Persian speakers in at least eight countries, which implies the relevance of our study results to a reasonably large audience.

The alpha coefficient of both of our questionnaires was higher than a typically accepted value of 0.70. [25] However, this coefficient was 8.0% higher for our MICRO-4 questionnaire as compared to MINI-MNA, despite being 1/3rd shorter. Beside other factors, Cronbach alpha is a function of correlation and covariance between items. So, if scale items are entirely independent from one another (i.e., they are not correlated or share no covariance), then alpha becomes zero. So, from our results, we may infer that alpha coefficient for MICRO-4 was better than MINI-MNA, possibly due to better correlation between its items as compared to those of MINI-MNA. This fact can be deduced from our results as well, wherein the item-test correlation was 20.8% higher in case of MICRO-4 as compared to MINI-MNA, despite having fewer items in MICRO-4. These results further re-affirm that having a greater number of items is not in itself a mark of a good, consistent and reliable questionnaire.

Although Cronbach alpha is often regarded as a sole uncritical index of validity, but it is not so. There are other indices, such as item-test correlation, group-based alpha coefficient or factor structure, which may ameliorate the problems related to uncritical use of Cronbach alpha as a sole index of reliability.[27] For instance, in our study, we also estimated the group alpha coefficients for responding a yes or no to a questionnaire item. This way, we could see whether there was a possible bias in providing a particular kind of response to the items by our participants. We found that the alpha coefficients for responding a yes or no to an item were closer to each other for both of our questionnaires; however, these coefficients were closer for MICRO-4 than MINI-MNA. Beside other possible explanations, this "closeness" of alpha coefficients between getting a yes or no to an item could be because shorter instruments help deriving focused responses from participants.[28]

In general, having brief questionnaires are beneficial and short evaluations can be as useful as lengthy interviews and instruments.[29] Also, fuller assessments are not always feasible in routine clinical practice.[30] Short length instruments are also more likely to generate interest, acceptance, motivation, and adherence from both the respondents and practitioners.[28] Moreover, the cross-cultural adaptation is more feasible with shorter instruments.[8,9]

One may argue that MNA has been supposedly validated in Iran. We are aware of two studies,[31,32] and both had

their fair share of methodological issues and poor results. For instance, the first study procured their participants from their own membership register, took an erroneous age definition of 65 years for older adults instead of the usual 60 years, and selected MNA items even with a very low item-test correlation of 0.20. They did not look at the factor analysis, group alpha coefficient or age-adjusted cut-point value for malnutrition, unlike our study. Their alpha coefficient (0.61) was poor and reported two specificity values of 63.0% and 62.0%. Moreover, this study itself recommended further studies to ameliorate psychometric properties for older adults at the risk of malnutrition in Iran.

The second study had acknowledged a selection bias as well as they erroneously considered healthy "controls" as a regular general population, unlike the way we had in our study. These healthy controls were recruited from among the medical staff and patient's relatives from their two hospitals. They excluded subjects with moderate to severe dementia, which is one of the screening items in MNA-MINI. Their scoring had apparent issues since they mentioned that MNA-MINI has 16 scores, while the maximum possible score in MNA-MINI is 14. Their alpha coefficient was also poor (0.66) and took the same erroneous age definition of older adults as the first study above. Their "best" cut-point value had a sensitivity of 58.0%. There were other methodological and quality differences between our study and these two studies.

Our MICRO-4 had excluded two items, including those pertaining to weight loss and neuropsychological status. In our study, the exclusion of these items was purely for statistical reasons. In theory, all items in a particular scale must together measure the same underlying concept of interest without distortion. For instance, including neuropsychological issues as a part of a screening criteria for malnutrition may otherwise introduce systematic error esp. in older adults among whom some changes do occur because of natural aging. Also, serious neuropsychological issues such as depression or dementia require detailed or separate evaluation of its own, at least the way we did in our study by using AMT. Similarly, weight loss may have gotten excluded in MICRO-4 probably because malnutrition is not an under-nutrition but an over-nutrition as well. There can be other possible explanations as well.[33]

Through factor analysis, we found MICRO-4 to be a unidimensional measure with all its items indicating a single underlying construct [34] of non-specific malnutrition.[30] These results were obtained after using the typical eigenvalue of ≥ 1.0 and factor loading ≥ 0.40. Upon CFA, we obtained a high value fit of 0.97, which indicates a good model fit.[35] These are desirable parameters for evaluating a disease detection tool.

We determined the probable cut-point for distinguishing malnutrition in our study setting. While we acknowledge that there can be no ideal or entirely undisputed cut-point, we used conventional ways to determine our cut-point, for instance by using a frequently used Youden index measure. Moreover, we used MINI-MNA as a gold-standard reference for cut-point purpose because it is widely believed to be a good malnutrition screening measure. In addition, we noted that our MICRO-4 questionnaire has high specificity and sensitivity values, but the specificity of our MICRO-4 was slightly higher than its sensitivity.

There is no doubt that both sensitivity and specificity are equally important. Although we could not find a suitable reference to quote, but through our results, we may speculate that a test with a higher specificity than sensitivity is likely to be more useful in settings, esp. for screening purpose, where regular clinical services are already drained out and over-used. This is so because, a test with a higher specificity would be more likely to bring the burden down on full diagnostic services by reducing the number of false alarms i.e., false-positive referrals. Nevertheless, the sensitivity value of our MICRO-4 was not stumpy either.

Lastly, our study has a few limitations. We recognize the utility of MINI-MNA as an internationally utilized malnutrition screening tool. However, our analyses highlighted some psychometric and practical limitations when applied specifically to our target population of older Iranian adults in the community. Our participants were from an urban setting, while the risk and scenario around evaluation of malnutrition may differ for rural residents. We derived our participants from three community-based sources, which were adapted to the context of our population. For instance, unlike rural set-ups, household approaches are unviable in urban areas. However, we made efforts to compensate for such limitations. For example, the recruitment from the main mosque was conducted on Thursday and Friday, which are mandatory days for coming to a mosque to pray. Similarly, parks in Iran are an important venue to fulfil leisure times and are accessible to almost everyone.[36] Further, although we have derived probable cut-point for distinguishing malnutrition using MICRO-4, the exact scope of its application remains to be assessed. Further, our MICRO-4 was derived from items that are already a part of an established screening questionnaire; hence, it could not benefit from additional possible perspectives about face and content validity.

Conclusion

We affirm that our Persian language MINI-MNA questionnaire was found to have adequate psychometric parameters for screening the risk of malnutrition among community-based older adults in a non-western context. However, our revised micro questionnaire provides far better psychometric properties. Being 1/3rd shorter, our questionnaire may swift the screening of non-specific malnutrition, esp. where full assessment and diagnostic services are already over-loaded. We acknowledge that our micro-questionnaire is not necessarily intended to substitute existing questionnaires, but rather to expand

on the possible ways to screen non-specific malnutrition among community-based older adults.

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Authors' Contribution

Conceptualization: Fatemeh Amini, Soodeh Razeghi Jahrom, Devender Bhalla.
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Competing Interests

All other authors have no conflicts of interest.

Ethical Approval

Ethical Approval for the study was obtained from Ethics Committee in University of Social Welfare and Rehabilitation Sciences, Tehran, Iran (Ethics Code: IR.USWR.REC.1395.126).

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References

1. Sathyanarayana Rao TS, Shaji KS. Demographic aging: implications for mental health. Indian J Psychiatry. 2007;49(2):78-80. doi: 10.4103/0019-5545.33251.
2. Otsu K, Shibayama K. Population aging and potential growth in Asia. Asian Dev Rev. 2016;33(2):56-73. doi: 10.1162/ADEV_a_00072.
3. Amini R, Ingman SR, Sahaf R. Aging in Iran: past, present and future. J Aging Emerg Econ. 2013;4(1):17-34.
4. Sorensen J, Kondrup J, Prokopowicz J, Schiesser M, Krähenbühl L, Meier R, et al. EuroOOPS: an international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. Clin Nutr. 2008;27(3):340-9. doi: 10.1016/j.clnu.2008.03.012.
5. Elia M, Russell CA. Combating Malnutrition: Recommendations for Action. Report from the Advisory Group on Malnutrition, Led by BAPEN. London, UK: British Association for Parenteral and Enteral Nutrition (BAPEN); 2009.
6. Hamirudin AH, Charlton K, Walton K. Outcomes related to nutrition screening in community living older adults: a systematic literature review. Arch Gerontol Geriatr. 2016;62:9-25. doi: 10.1016/j.archger.2015.09.007.
7. Adams NE, Bowie AJ, Simmance N, Murray M, Crowe TC. Recognition by medical and nursing professionals of malnutrition and risk of malnutrition in elderly hospitalised patients. Nutr Diet. 2008;65(2):144-50. doi: 10.1111/j.1747-0080.2008.00226.x.
8. Al-Zeer O, Ozcagli TG, Uyar M. A call-to-action from the feedM.E. Middle East study group. Use of a screen-intervene-supervene strategy to address malnutrition in healthcare. Saudi Med J. 2015;36(8):903-10. doi: 10.15537/smj.2015.8.11671.
9. Green SM, James EP. Barriers and facilitators to undertaking nutritional screening of patients: a systematic review. J Hum Nutr Diet. 2013;26(3):211-21. doi: 10.1111/jhn.12011.
10. Swan L, Martin N, Horgan NF, Warters A, O'Sullivan M. Assessing Sarcopenia, Frailty, and Malnutrition in Community-Dwelling Dependant Older Adults-An Exploratory Home-Based Study of an Underserved Group in Research. Int J Environ Res Public Health. 2022;19(23). doi: 10.3390/ijerph192316133.
11. Power L, Mullally D, Gibney ER, Clarke M, Visser M, Volkert D, et al. A review of the validity of malnutrition screening tools used in older adults in community and healthcare settings - a MaNuEL study. Clin Nutr ESPEN. 2018;24:1-13. doi: 10.1016/j.clnesp.2018.02.005.
12. Marshall S, Craven D, Kelly J, Isenring E. A systematic review and meta-analysis of the criterion validity of nutrition assessment tools for diagnosing protein-energy malnutrition in the older community setting (the MACRo study). Clin Nutr. 2018;37(6 Pt A):1902-12. doi: 10.1016/j.clnu.2017.09.022.
13. Cascio BL, Logomarsino JV. Evaluating the effectiveness of five screening tools used to identify malnutrition risk in hospitalized elderly: a systematic review. Geriatr Nurs. 2018;39(1):95-102. doi: 10.1016/j.gerinurse.2017.07.006.
14. van Venrooij LMW, de Vos R, Borgmeijer-Hoelen AM, Kruizenga HM, Jonkers-Schuitema CF, de Mol BA. Quick-and-easy nutritional screening tools to detect disease-related undernutrition in hospital in- and outpatient settings: a systematic review of sensitivity and specificity. E Spen Eur E J Clin Nutr Metab. 2007;2(2):21-37. doi: 10.1016/j.eclnm.2007.03.001.
15. Urteaga C, Ramos RI, Atalah E. [Validation of global nutrition assessment in elders]. Rev Med Chil. 2001;129(8):871-6. [Spanish].
16. Abdul Latiff L, Nor Afiah M, Shashikala S. Psychological well-being of the elderly people in Peninsular Malaysia. IIUM Med J Malays. 2005;4(2):1-8.
17. Mortazavi SS, Shati M, Malakouti SK, Khankeh HR, Mehravaran S, Ahmadi F. Physicians' role in the development of inappropriate polypharmacy among older adults in Iran: a qualitative study. BMJ Open. 2019;9(5):e024128. doi: 10.1136/bmjopen-2018-024128.
18. Hair JE, Anderson RE, Tatham RL, Black WC. Multivariate Data Analysis: With Readings. New Jersey: Prentice-Hall; 1995.
19. Cattell RB. The Scientific Use of Factor Analysis in Behavioral and Life Sciences. New York: Springer; 1978.
20. Comrey AL, Lee HB. A First Course in Factor Analysis. New Jersey: Lawrence Erlbaum Associates; 1992.
21. Johansson L, Sidenvall B, Malmberg B, Christensson L. Who will become malnourished? A prospective study of factors associated with malnutrition in older persons living at home. J Nutr Health Aging. 2009;13(10):855-61. doi: 10.1007/s12603-009-0242-3.
22. Tsang S, Royse CF, Terkawi AS. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. Saudi J Anaesth. 2017;11(Suppl 1):S80-9. doi: 10.4103/sja.SJA_203_17.
23. Haladyna TM. Developing and Validating Multiple-Choice Test Items. New Jersey: Lawrence Erlbaum Associates; 1999.
24. Perneger TV, Courvoisier DS, Hudelson PM, Gayet-Ageron A. Sample size for pre-tests of questionnaires. Qual Life Res. 2015;24(1):147-51. doi: 10.1007/s11136-014-0752-2.
25. Singh AS, Vik FN, Chinapaw MJ, Uijtdewilligen L, Verloigne M, Fernández-Alvira JM, et al. Test-retest reliability and construct validity of the ENERGY-child questionnaire on energy balance-related behaviours and their potential determinants:

the ENERGY-project. Int J Behav Nutr Phys Act. 2011;8:136. doi: 10.1186/1479-5868-8-136.
26. Foroughan M, Wahlund LO, Jafari Z, Rahgozar M, Farahani IG, Rashedi V. Validity and reliability of Abbreviated Mental Test Score (AMTS) among older Iranian. Psychogeriatrics. 2017;17(6):460-5. doi: 10.1111/psyg.12276.
27. Agbo AA. Cronbach's alpha: review of limitations and associated recommendations. J Psychol Afr. 2010;20(2):233-9. doi: 10.1080/14330237.2010.10820371.
28. Bolarinwa OA. Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. Niger Postgrad Med J. 2015;22(4):195-201. doi: 10.4103/1117-1936.173959.
29. Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry. 2003;60(2):184-9. doi: 10.1001/archpsyc.60.2.184.
30. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med. 2002;32(6):959-76. doi: 10.1017/s0033291702006074.
31. Amirkalali B, Sharifi F, Fakhrzadeh H, Mirarefin M, Ghaderpanahi M, Larijani B. Evaluation of the Mini Nutritional Assessment in the elderly, Tehran, Iran. Public Health Nutr. 2010;13(9):1373-9. doi: 10.1017/s1368980010000303.
32. Ghazi L, Fereshtehnejad SM, Abbasi Fard S, Sadeghi M, Shahidi GA, Lökk J. Mini Nutritional Assessment (MNA) is rather a reliable and valid instrument to assess nutritional status in Iranian healthy adults and elderly with a chronic disease. Ecol Food Nutr. 2015;54(4):342-57. doi: 10.1080/03670244.2014.994743.
33. Kanke S, Kawai T, Takasawa N, Mashiyama Y, Ishii A, Kassai R. Interventions for body weight reduction in obese patients during short consultations: an open-label randomized controlled trial in the Japanese primary care setting. Asia Pac Fam Med. 2015;14(1):5. doi: 10.1186/s12930-015-0022-7.
34. Bougie E, Arim RG, Kohen DE, Findlay LC. Validation of the 10-item Kessler Psychological Distress Scale (K10) in the 2012 aboriginal peoples survey. Health Rep. 2016;27(1):3-10.
35. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Modeling. 1999;6(1):1-55. doi: 10.1080/10705519909540118.
36. Breuste J, Rahimi A. Many public urban parks, but who profits from them? The example of Tabriz, Iran. Ecol Process. 2015;4(1):6. doi: 10.1186/s13717-014-0027-4.