

Validity of the Kihon Checklist for Evaluating Frailty Status in Turkish Older Adults
(The Kihon Checklist for frailty)

**Mehmet Erdinc ESENKAYA¹, Ozge DOKUZLAR², Pinar SOYSAL³, Lee SMITH⁴,
Sarah E Jackson⁵, Ahmet Turan ISIK^{2,6}**

¹Department of Internal Medicine, Dokuz Eylul University, Faculty of Medicine, Izmir, Turkey

²Department of Geriatric Medicine, Dokuz Eylul University, Faculty of Medicine, Izmir, Turkey

³Department of Geriatric Medicine, Bezmialem Vakif University, Faculty of Medicine, Istanbul, Turkey

⁴The Cambridge Centre for Sport and Exercise Sciences, Anglia Ruskin University, Cambridge, United Kingdom

⁵Department of Behavioural Science and Health, University College London, London, United Kingdom

⁶Unit for Aging Brain and Dementia, Department of Geriatric Medicine, Dokuz Eylul University, Faculty of Medicine, Izmir, Turkey

Correspondence to: Ahmet Turan ISIK, M.D.

Unit for Aging Brain and Dementia, Department of Geriatric Medicine, Dokuz Eylul University, Faculty of Medicine, 35340, Balçova, Izmir, Turkey

+90 232 412 43 41

atisik@yahoo.com

+90 232 412 43 39

Abstract (248/250)

Aims: The Kihon Checklist (KCL) was developed to identify vulnerable older adults residing in Japan who are at a high risk of becoming dependent. The present study aimed to determine validity of the KCL for detecting frailty in Turkish older adults.

Methods: A total of 300 outpatients were enrolled in the study. All patients underwent comprehensive geriatric assessment and completed a Turkish translation of the KCL. Frailty status was defined by 5 dimensions, including weight loss, exhaustion, low levels of activity, weakness, and slowness: 0 for robust, 1-2 for prefrail, and 3-5 for frail.

Results: The mean age of the patients was 73.85 ± 7.12 years. According to Fried definitions, 25.7% were considered frail, 48.0% prefrail, and 26.3% robust. There was a significant difference between the groups in terms of age, gender, education, Charlson's Comorbidity Index, the number of medications used, sarcopenia, dynapenia and all the comprehensive geriatric assessment parameters ($p < 0.05$). Cronbach's α value of the KCL was 0.876. The area under the receiver-operating characteristics curve was 0.855 for frail, and 0.697 for prefrail. We found that KCL can show frail and prefrail older adults when the cut-off values are ≥ 9 and ≥ 4 , respectively, with a sensitivity of 80.52% and 65.28% and specificity of 81.17% and 56.96%.

Conclusions: The KCL can be used as a quick, simple, and sensitive screening method for detecting frailty among Turkish older adults. We recommend its use

by healthcare professionals in Turkey in order to identify frail older adults and direct them to relevant support.

Keywords: Frailty, geriatric assessment, Kihon Checklist, older adults

Introduction

The elderly population is increasing globally. Epidemiological studies show that 11% of the world's population is over 60 years of age, and this is forecast to increase to 22% by 2050 (1). However, a long life does not necessarily mean a healthy life (2). Frailty is the difficulty in restoring the homeostatic balance against stress factors developing with age. Although there are many factors in its pathogenesis, it is defined as a medical syndrome characterized by a decrease in strength and stamina, an increase in external dependence and a decline in physical functions (3). The reduced capacity of the organism increases the risk of undesirable health outcomes such as falling, hospitalization, disability, institutionalization and mortality (4,5).

Although many scales have been developed for the diagnosis of frailty, there is still no gold standard method for diagnosis because of the condition's multifactorial etiopathogenesis. The Kihon Checklist (KCL), which comprises 25 yes/no questions covering a range of factors including instrumental and social activities of daily living, physical functions, nutritional status, oral function, cognitive function, and depressive mood, was created in 2006 to identify vulnerable older adults who has a higher risk of becoming dependent in Japan (6). The KCL has been translated into several different languages, including English (7), Portuguese (8) and Spanish (9), and its validity for identifying frailty has been established in 2016 (10). Any question in favor of dependency and frailty is considered as a score in the KCL and indicates that the individual is at a high risk of needing support or care in the relevant field (7). The prevalence of frail and prefrail older adult in Turkey is high (11,12). Therefore, easy-to-apply

frailty scales are needed for early detection of these patients. The aim of our study was to test the validity of a Turkish version of KCL, and to evaluate its strength in determining the frailty defined by Fried criteria.

Method

Procedure

A total of 375 outpatients, who were admitted to Dokuz Eylul University, Department of Geriatrics between January 2017 and April 2017 for any health issue and volunteered to participate in the study were evaluated. As a result of comprehensive geriatric assessment by a geriatrician, 300 outpatients who did not have exclusion criteria, were included in this study.

Patients who had a history of severe illness that may impair general health status (such as an acute cerebrovascular event, gastrointestinal bleeding, sepsis, acute renal failure, acute coronary syndrome, acute liver failure, or acute respiratory failure) and those under 60 years of age were excluded from the study. In addition, patients who had a diagnosis of CDR-2 and CDR-3 dementia were excluded from the study, because self-reports based on their memory might be unreliable for both KCL and Fried questions, and the reliability of hand grip strength is low for older patients with dementia because of the difficulty of judgment and conception, which can cause them to fail to fully comprehend and complete tasks.

A geriatrician evaluated and recorded demographic characteristics (age, gender, and educational status), comorbidities and Charlson's Comorbidity Index score and the number of drugs used by the patients. Serum thyroid-stimulating

hormone, vitamin D, vitamin B12, folic acid levels, and glomerular filtration rates were recorded to evaluate the metabolic status of the patients. Dementia was diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria (13).

The ethics committee of The Dokuz Eylul University, Turkey, approved the study protocol with a decision number 3098-GOA. Each participant or a legal guardian provided written, informed consent to participate in the study. We carried out this study in accordance with the provisions of the Declaration of Helsinki.

Comprehensive Geriatric Assessment (14)

The following assessments were used for detailed geriatric evaluation by a geriatricians: The Mini-Mental State Examination (MMSE), The Clinical Dementia Rating scale (CDR) and The Clock Drawing Test (CDT) (15) were used for neurocognitive assessment; The Geriatric Depression Scale (GDS) (16) for emotional state assessment; The Lawton-Brody Instrumental Daily Living Activity Scale (IADL) and Barthel index (BADL) for activities of daily living; the Mini Nutritional Assessment (MNA) for nutritional evaluation; and the Tinetti Performance-Oriented Assessment of Mobility (POMA) and Timed Up and Go (TUG) test for mobility evaluation.

Translation procedure

Translating the KCL into Turkish was a five-stage process. 1) The first stage was to obtain a translation permission from the authors of the original scale. 2) Three independent translations into Turkish were done by three native linguistic specialists. All the translators were blind to each other's translation. 3)

Then, the translations were analyzed by another researcher who was a native Turkish speaker, and turned into a single text. 4) This consensus forward version was back translated into English by two native linguistic specialists; the backward version and the original text were compared with English translation. None of the items of the Turkish text needed any modifications following this stage. 5) The final text was applied to ten patients, in order to test whether there were any problems in practice. None were detected.

Diagnosis of sarcopenia and dynapenia (17)

For the evaluation of walking speed, muscle strength and muscle mass in patients, 4-meter walking test, handgrip test and bioimpedance were performed for each patient, respectively. Handgrip test was measured by JAMAR branded hand dynamometer, and bioimpedance was established by TANITA (MC-780U Multi Frequency Segmental Body Composition). We accepted slow walking speed < 0.8 m/s, low hand grip power in women < 20 kg, in males < 30 kg .Based on muscle mass bioimpedance values, Skeletal muscle (kg) = (height² / R × 0.401) + (sex × 3.825) + (age × - 0.071) + 5.102 is formulated. Values in terms of Resistance (R) 50 Hz hand-leg (body), length in centimeters, female gender 0, male gender 1, age in years are accepted and replaced in formula. The muscle mass index (SMI = muscle mass / height²) was calculated by dividing the muscle mass in kg by length in square meter which was obtained to prevent the muscle mass from varying according to the height. SMI was regarded as low muscle mass < 8.87 kg/m² for males and < 6.42 kg/m² for females.

Decreased muscular strength and/or walking speed together with decreased muscle mass were evaluated as sarcopenia. Without any decrease in muscle mass, decreased muscle strength was defined as dynapenia.

Kihon Checklist

The KCL comprises 25 self-reporting yes/no questions regarding instrumental (3 questions) and social (4 questions) activities of daily living, physical functions (5 questions), nutritional status (2 questions), oral function (3 questions), cognitive function (3 questions), and depressive mood (5 questions). Any question in favor of disability and frailty is considered as a score in the KCL and indicates that the individual is at a high risk of requiring support or care in that domain.

Diagnosis of Frailty

Frailty status was defined based on 5 dimensions of frailty phenotype, including shrinking, exhaustion, and low levels of physical activity, weakness, and slowness. People with 0 criteria were considered robust, 1-2 prefrail, and >3 frail, as suggested by Fried et al. (18). A weight loss >4.5 kg within the past year (either measured or reported by the patient or patients' caregivers) was taken as a sign of shrinking. The exhaustion criterion was met if the answer was "much or most of the time" when asked, "How often in the last week did you feel this way" to either of the following two statements: "I felt that everything I did was an effort" and "I could not get going." Weakness, assessed by grip strength of the dominant hand (mean of 3 measurements) with dynamometer, was accepted to be less than or equal to the cut-off points according to sex and body mass index points,

which were determined by Fried et al. (18). Low levels of physical activity were considered as decisive in patients who had no physical activity, spent most of the time sitting, or rarely had short walks in the past year, instead of using Minnesota Leisure Time Questionnaire (19). Low gait speed was evaluated using the 4-m walking test, and if the time to complete the test was less than or equal to the cut-off points according to sex and height (18), it was regarded as slowness.

Statistics

Statistical analyses were performed by the Statistical Package for Social Sciences (SPSS) version 22.0 for Windows (SPSS Inc, Chicago, IL) and PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA). Nominal variables were assessed by Pearson Chi-Square test. Continuous variables with normal distribution were analyzed with One-way ANOVA followed by a post-hoc test, and The Kruskal Wallis test was used to assess the presence of non-normal distribution (It is shown as the p_1 value in Table 1). Adjustment according to age, gender and educational status was done by multinomial logistic regression analysis (It is shown as the p_2 and p_3 value in Table 1). The Kappa consistency test was used to evaluate the consistency between the Fried Frailty Index and the items of KCL, and also to assess concurrent validity. Internal consistency was assessed from Cronbach's alpha value. The receiver operating characteristics (ROC) curves used for evaluating the validity of the KCL for estimating frailty status. The cut-off value for the optimal estimation of frailty status was determined using the Youden Index. Sensitivity, specificity, and positive and negative predictive values (PPV and NPV) were calculated for cut-off scores. The correlation of KCL total test scores with CCI, POMA, TUG, MMSE,

CDT, CDR, BADL, IADL, MNA scores and BMI were assessed by Spearman's correlation coefficient. In all analyses, $p < 0.05$ was considered to indicate statistical significance. A sample size of 272 participants was calculated to ensure that the minimum required size was within a 95% confidence interval and 5% standard error, based on a previous study (12) that reported the prevalence of frailty was 26.3%.

Results

A total of 300 patients over 60 years of age were included in our study. The mean age of the patients was 73.85 ± 7.12 years and 72% were female. The patients were divided into three groups as robust, prefrail and frail according to the Fried criteria: 25.7% of the patients were frail, 48% were prefrail and 26.3% were robust. When the patients were evaluated according to the groups, there was a significant difference between the groups in terms of age, gender and education level. ($p < 0.001$). Demographic data of the patients are summarized in Table 1. Following the detailed geriatric evaluation, when MMSE, CDT, CDR, Geriatric depression scale, POMA, TUG, BADL, IADL, MNA scores and body mass index were evaluated. There was a significant difference between the groups ($p < 0.001$). Sarcopenia and dynapenia also showed a significant difference between the groups ($p < 0.001$). p values are shown in Table 2 after adjustment for age, sex and educational status.

The mean total score of KCL was 12.25 ± 4.82 in the frail group, 6.27 ± 4.61 in the prefrail group and 3.35 ± 3.01 in the robust group and there was a significant difference between the groups ($p < 0.001$). The Cronbach's α coefficient

of the KCL was 0.876. This result showed that the internal consistency of the scale was sufficient. The Kappa value for determining the frailty of each problem in the KCL is shown in Table 2.

ROC curves drawn for frail and non-frail, frail and robust, prefrail and robust groups, area under the curve and p values are shown in Figure 1. According to the data obtained from the ROC curve, the sensitivity, specificity, positive predictive and negative predictive values of the cut-off points for frail and prefrail older adults are shown in Table 3. In addition, KCL total test scores were significantly correlated with CCI, POMA, TUG, MMSE, CDT, CDR, BADL, IADL, MNA scores and BMI ($p < 0.05$) (Table 4).

Discussion

In this study, the Kihon Checklist was found to be a valid scale for evaluating frailty in Turkish older adults. We also showed that the KCL, which has also been used as a frailty scale in recent years, can distinguish frail and prefrail older adults with cut-off values of ≥ 9 and ≥ 4 , respectively. The world population is getting older, with life expectancy increasing (20). Increased frailty with advancing age has been found to be associated with many negative consequences such as limitation in daily life activities, decrease in mobilization, loss of cognitive function, increased frequency of hospitalization, and mortality (21). Although the prevalence of frailty varies according to the scales used, it is between 7% and 12% among individuals over 65 years of age (22). In a study conducted in Turkey, the prevalence of frailty was found to be 26.3% in individuals over the age of 65 years (12). Similarly, the prevalence of frailty in the

present study was 25.7%. It is known that frailty is more common in female sex. The reasons for this may include longer life expectancy for women, changes in biological factors such as hormones, inflammatory cytokines, sarcopenia, and educational status (23). In fact, female gender is considered a risk factor for frailty (24). In our study, the frailty rate in women was found to be high in accordance with the literature. In addition, age is one of the most important risk factors for frailty (24). In our study, it was also found that frailty increased with advancing age. Studies have shown that the low education level is among the risk factors for frailty (25). This is attributed to multifactorial reasons such as individuals with a higher education status preferring a healthier lifestyle and having better financial means (25). Similarly, in our study, a significant relationship was found between education level and frailty. Malnutrition and low walking speed related to frailty are even problems that are in diagnostic criteria (18,26). It is known that malnutrition causes frailty, and low walking speed, balance disorders, falls, immobility and dependence are more common in frail individuals (11,27). One of the reasons for this may be the intertwined etiopathogenesis of sarcopenia and frailty, and also the loss of the muscle strength and muscle mass. Another dimension of frailty is the cognitive frailty (3). For these reasons, frailty is expected to be associated with the components of the comprehensive geriatric assessment, which evaluates parameters such as nutrition, functionality, cognitive functions, and mood. In our study, the relevance of frailty to all the comprehensive geriatric assessment parameters further highlights the importance of the subject.

Although many scales have been developed for the diagnosis of frailty, there is no gold standard method because of the multifactorial etiopathogenesis of frailty. There is a need for simple, easy to use, fast scales that can be used by all physicians in daily practice. The KCL consists of 25 yes/no questions that are easy to understand and apply. Therefore, it is validated in English (7), Portuguese (8) and Spanish (9) and it was shown that it is a valid scale for the diagnosis of frailty (10). In our study, we found that the KCL has good internal consistency (Cronbach's α value 0.876) in Turkish older adults. In order to distinguish between frail and prefrail older adults, the most appropriate cut-off points are ≥ 9 and ≥ 4 , respectively. In a study conducted in Japan, these cut-off points were ≥ 8 and ≥ 4 , respectively (10). Although the sensitivity and specificity values of the groups with and without frailty were similar (sensitivity 89.5% and specificity 80.7%), the sensitivity and specificity values were lower in our study to distinguish prefrail and robust elderly. Again, Ogawa et al. using the Fried criteria in the validation of the first 20 questions of KCL with ≥ 6 cut-off point with the frail older adults 60.0% sensitivity and 86.4% specificity was found to be separated from the others (28). The conclusion of the cut-off point in this study with our study may be that the last 5 problems are not taken into consideration.

In our study, the questions 5, 12, 13, 14, 15 and 20 have the lower Kappa values. These questions are the ones that evaluate social, nutritional, chewing and swallowing, and cognitive functions. It was thought that the low discriminatory power of questions related to cognitive function was related to the lack of evaluation of cognitive frailty in our study because the Fried criteria were used. In our study, questions about nutrition and weight loss are limited in determining

frailty. Studies have shown that frailty is more common in obese people (29). Similarly in our study, BMI was higher in the frail group. In addition, the rate of sarcopenia and dynapenia is higher in the frail group. These results may be associated with sarcopenic obesity, whose importance is even more common (30). Another domain with low discriminative power in detecting frail patients is concerned with the questions about chewing and swallowing. It was thought that comprehensive geriatric assessment parameters and the Fried criteria were not related to the evaluation of dysphagia, chewing and swallowing functions. Evaluation of oral functions may be one of the strengths of KCL. In our study, another question with limited power to assess frailty according the Kappa value is the 24th question that query about "feeling helpless". In previous studies in Turkish older adults, the questions about "feeling helpless" has been shown to have low discriminative power in screening for depression (16). These reasons may explain the low sensitivity and specificity of the frail candidate of the KCL and the control group.

Strengths of our study include the prospective design and that the diagnosis of frailty was established according to Fried criteria which is one of the most accepted scales and that a sufficient number of patients over the age of 60 were included in the study. One of the limitations of our study is that cognitive frailty is not evaluated. We did not examine the association between KCL and cognitive frailty, and such research can be necessary for the future. Another is the fact that CDR-2 and CDR-3 dementia patients were excluded from the study and the results therefore may not generalize to patients with dementia.

The Kihon Checklist is a simple, fast and easy-to-use scale that can be applied in clinical practice without the need for additional training. The evaluation of problems in 7 different domains allows for detection of problem areas. In addition, the evaluation of cognitive functions, chewing and swallowing functions in the KCL offer advantages over the Fried criteria. The KCL, which is found to be valid in Turkish older adults and can distinguish frailty with high sensitivity and specificity, is a scale that can be used by all health workers in order to identify and guide older adults in the early stages of frailty.

Disclosure statement

No potential conflicts of interest were disclosed.

Acknowledgment

The authors thanks to Hulya ELLIDOKUZ and Yasin BUYUKKOR for statistical analysis.

References

1. Kanasi E, Ayilavarapu S, Jones J. The aging population: demographics and the biology of aging. *Periodontol 2000*. 2016;72(1):13–8.
2. Villacampa-Fernández P, Navarro-Pardo E, Tarín JJ, Cano A. Frailty and multimorbidity: Two related yet different concepts. *Maturitas*. 2017;95:31-5.
3. Morley JE, Vellas B, Abellan van Kan G, Anker SD, Bauer JM, Bernabei R, et al. Frailty consensus: A call to action. *J Am Med Dir Assoc*. 2013;14(6):392–7.
4. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. *Lancet*. 2013;381(9868):752–62.
5. Rodríguez-Mañas L, Féart C, Mann G, Viña J, Chatterji S, Chodzko-Zajko W, et al. Searching for an operational definition of frailty: A delphi method based consensus statement. the frailty operative definition-consensus conference project. *J Gerontol A Biol Sci Med Sci*. 2013;68(1):62–7.
6. Tomata Y, Hozawa A, Ohmori-Matsuda K, Nagai M, Sugawara Y, Nitta A, et al. [Validation of the Kihon Checklist for predicting the risk of 1-year incident long-term care insurance certification: the Ohsaki Cohort 2006 Study]. *Nihon Koshu Eisei Zasshi*. 2011;58(1):3–13.
7. Arai H, Satake S. English translation of the Kihon Checklist. *Geriatr*

- Gerontol Int.* 2015;15(4):518–9.
8. Sewo Sampaio PY, Sampaio RAC, Yamada M, Ogita M, Arai H. Validation and translation of the Kihon Checklist (frailty index) into Brazilian Portuguese. *Geriatr Gerontol Int.* 2014;14(3):561–9.
 9. Maseda A, Lorenzo-López L, López-López R, Arai H, Millán-Calenti JC. Spanish translation of the Kihon Checklist (frailty index). *Geriatr Gerontol Int.* 2017;17(3):515–7.
 10. Satake S, Senda K, Hong YJ, Miura H, Endo H, Sakurai T, et al. Validity of the Kihon Checklist for assessing frailty status. *Geriatr Gerontol Int.* 2016;16(6):709–15.
 11. Soysal P, Isik AT, Arik F, Kalan U, Eyvaz A, Veronese N. Validity of the Mini-Nutritional Assessment Scale for Evaluating Frailty Status in Older Adults. *J Am Med Dir Assoc.* 2018;S1525-8610(10):30410–9.
 12. Dokuzlar O, Soysal P, Isik AT. Association between serum vitamin B12 levels and frailty in older adults. *North Clin Istanb.* 2017;4(1):22–8.
 13. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Arlington. 2013. <https://doi.org/10.1176/appi.books.9780890425596>
 14. Unutmaz GD, Soysal P, Tuven B, Isik AT. Costs of medication in older patients: Before and after comprehensive geriatric assessment. *Clin Interv Aging.* 2018;13:607–13.
 15. Shulman KI. Clock-drawing: Is it the ideal cognitive screening test? *Int J*

- Geriatr Psychiatry*. 2000;15(6):548–61.
16. Dokuzlar O, Soysal P, Usarel C, Isik AT. The evaluation and design of a short depression screening tool in Turkish older adults. *Int Psychogeriatr*. 2018;30(10):1541–8.
 17. Ates Bulut E, Soysal P, Aydin AE, Dokuzlar O, Kocyigit SE, Isik AT. Vitamin B12 deficiency might be related to sarcopenia in older adults. *Exp Gerontol*. 2017;95:136–40.
 18. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in Older Adults: Evidence for a Phenotype. *J Gerontol A Biol Sci Med Sci*. 2001;56(3):M146-56.
 19. Cesari M, Leeuwenburgh C, Lauretani F, Onder G, Bandinelli S, Maraldi C, et al. Frailty syndrome and skeletal muscle: Results from the Invecchiare in Chianti study. *Am J Clin Nutr*. 2006;83(5):1142-8.
 20. Sewo Sampaio PY, Sampaio RAC, Yamada M, Arai H. Systematic review of the Kihon Checklist: Is it a reliable assessment of frailty? *Geriatr Gerontol Int*. 2016;16(8):893–902.
 21. Kojima G. Frailty Defined by FRAIL Scale as a Predictor of Mortality: A Systematic Review and Meta-analysis. *J Am Med Dir Assoc*. 2018;19(6):480–3.
 22. Fried LP, Ferrucci L, Darer J, Williamson JD, Anderson G. Untangling the Concepts of Disability, Frailty, and Comorbidity: Implications for Improved Targeting and Care. *J Gerontol A Biol Sci Med Sci*. 2004;59(3):255–63.

23. Gordon EH, Peel NM, Samanta M, Theou O, Howlett SE, Hubbard RE. Sex differences in frailty: A systematic review and meta-analysis. *Exp Gerontol.* 2017;89:30–40.
24. Rockwood K. What would make a definition of frailty successful? *Age Ageing.* 2005;34(5):432–4.
25. Hoogendijk EO, van Hout HPJ, Heymans MW, van der Horst HE, Frijters DHM, Broese van Groenou MI, et al. Explaining the association between educational level and frailty in older adults: Results from a 13-year longitudinal study in the Netherlands. *Ann Epidemiol.* 2014;24(7):538–44.
26. van Kan GA, Rolland YM, Morley JE, Vellas B. Frailty: Toward a Clinical Definition. *J Am Med Dir Assoc.* 2008;9(2):71–2.
27. Cesari M. Role of gait speed in the assessment of older patients. *JAMA.* 2011;305(1):93–4.
28. Ogawa K, Fujiwara Y, Yoshida H, Nishi M, Fukaya T, Kim M, et al. The validity of the “Kihon Check-list” as an index of frailty and its biomarkers and inflammatory markers in elderly people. *Nihon Ronen Igakkai Zasshi.* 2011;48(5):545–52.
29. Shivappa N, Stubbs B, Hébert JR, Cesari M, Schofield P, Soysal P, et al. The Relationship Between the Dietary Inflammatory Index and Incident Frailty: A Longitudinal Cohort Study. *J Am Med Dir Assoc.* 2018;19(1):77–82.
30. Kalinkovich A, Livshits G. Sarcopenic obesity or obese sarcopenia: A cross

talk between age-associated adipose tissue and skeletal muscle inflammation as a main mechanism of the pathogenesis. *Ageing Res Rev.* 2017;35:200–21.

Figure 1. Receiver operating characteristic curve (ROC) analysis of the KCL.