VALIDATION OF MINI NUTRITIONAL ASSESSMENT LONG-FORM TOOL FOR SCREENING MALNUTRITION AMONG ELDERLY POPULATION IN MEKI TOWN, ETHIOPIA.

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Validation of mini nutritional assessment long-form tool for screening malnutrition among elderly population, Meki town, Ethiopia: a cross-section validation study

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Abstract

Background: Among various malnutrition screening tools, the mini nutritional assessment (MNA) long-form is a simple and valid tool used to assess nutritional status in the elderly population. It is easily administered within 10 to 15 minutes and does not require laboratory investigation. Although it has been validated and used worldwide, not yet validated in Ethiopia.

Objective: To validate the MNA long-form for screening malnutrition among the elderly population aged 60 years and above living in the community.

Method: Community based cross-sectional validation study was conducted among 176 elders from March 30 to April 30, 2020, using a simple random sampling technique in Meki town, East Ethiopia. All apparently healthy elderly people aged 60 years and above who have been living in Meki town for 6 months and above were included. Whereas amputated, bedridden, edematous, those with visible of deformity, and known liver and/or kidney disease were excluded.

Data were collected using pretested Afan Oromo and Amharic version MNA long-form questionnaires by trained 2 BSc nurses. A fasted venous blood sample was collected by trained 2 BSc laboratory technicians for serum albumin concentration analysis using the Bromocresol green (BCG) method.

Lastly, collected data were edited, entered into Epidata version 3.1 then exported to SPSS version 25 for Analysis. Mean. Standard deviation (SD), frequency, and percent (%) were calculated for the variable of interest. P-value< 0.05 was used to declare significance.

Criterion-related validity and its subtype concurrent validity were assessed. Sensitivity, specificity, internal consistency, total diagnostic accuracy, positive predictive value (PPV), and negative predictive value (NPV) were calculated. The receiver-operating characteristic curve (ROC-curve) was done to calculate the area under the curve (AUC) and a new optimal cut off value with its optimal sensitivity and specificity.

Result: Out of 176 subjects, 44.3% were males. The mean (SD) age of 67.6 (5.79) years. The prevalence of malnutrition was 18.2% using MNA long-form (<17 points) and 13.1% using Serum albumin concentration level (<3g/dl).

MNA long-form had strong internal consistency with Cronbach's alpha 0.605 and a significant correlation was found with all items (Spearman's rho (rs)>0.242; P<0.05). MNA long-form showed that criterion-related validity was significant with serum albumin concentration (Spearman's rho (rs) =0.746; p <0.05). Also, concurrent validity was significant with the self-perception of nutritional status (Spearman's rho (rs) =0.514; p<0.05). Additionally, it showed moderate agreement with serum albumin concentration (Weighted kappa (Kw) =0.556; p<0.05).

According to original cut off value, MNA long-form had a sensitivity of 93.5%, a specificity of 44.6%, PPV of 65.4%, and NPV of 86.0%. However, using a new cut off value <20.5, to identify markers of malnutrition with serum albumin concentration used as a golden standard, found a sensitivity of 97.6%, and a specificity of 82.8%. The AUC (95% CI) showed an excellent overall accuracy of 92.7% (88.5, 96.9).

Conclusion and recommendation: MNA long-form tool, can be used as a valid screening tool to assess nutritional status among the elderly population in Ethiopia with modification of the original established cut off value. A future study using a combination of various biomarkers as a golden standard to validate the MNA long-form is needed.

Keywords: MNA long-form, Meki town, Elderly, Ethiopia.

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Acronyms and abbreviations

AUC = Area under the Curve

BCG = Bromocresol green

BMI= Body Mass Index

CC = Calf Circumference

CGA = Comprehensive Geriatric Assessment

ESPEN = European Society for Parenteral and Enteral Nutrition

g/dl = gram/deciliter

IAGG = International Association of geriatrics and gerontology

K*w* = Weighted Kappa

ml = milliliters

MNA =Mini Nutritional Assessment

MUAC = Mid Upper Arm Circumference

NPV = negative predictive value

PPV = positive predictive value

ROC = Receiver Operating Characteristics

SD = Standard Deviation

SOP = Standard Operating Procedure

SPSS =Statistical Package for Social Science

WHO = World Health Organization

Chapter one

1. Introduction

1.1. Background

Elderly people refer to older persons aged 60 and above (1, 2). This age group is affected by the dual burden of malnutrition and chronic non-communicable disease (3-5). Malnutrition is defined as consuming inadequate or excess nutrients (6). However, here malnutrition was used to refer undernutrition.

Early detection of those at risk of malnutrition and treating malnutrition to avert the nutritional related adverse outcome like physical function, recovery from disease, and complication including mortality (7, 8) is the core health care process. Nutritional screening and assessment are very crucial to prevent malnutrition and its complications in elderly people. They are part of the compressive geriatric assessment (CGA) (9). CGA includes both early detections of malnutrition in elderly people and recommendation of the best alternative treatment to avert malnutrition(10, 11). There are different tools used to screen and assess nutritional status in the elderly population. Among these, MNA long-form is used and recommended in different countries (12).

MNA long-form tool was developed in the early 1990s during the International Association of geriatrics and gerontology (IAGG) meeting in Acapulco and published in 1994(13). It is short and completed only within 10 -15 minutes(9). It has 18 items with four categories anthropometric, dietary assessment, global and subjective assessment. All items are attributed to score and the total score is summed from all items. It has 30 maximum points with three cut off points for categorizing the elderly people's nutritional status. It classifies the nutritional status of the elderly population as malnutrition(undernutrition) less than 17 points, 17-23.5 at risk of malnutrition, and 24-30 points well-nourished (14).

Even though there is no single generally accepted criteria for screening and assessment of malnutrition among the elderly population (15), MNA long-form is the only nutritional screening and assessment tool that incorporates functionality, mobility, depression(15, 16). It is simple, inexpensive, does not require laboratory investigation, and reliable tool for screening malnutrition in the elderly population(13, 17). Other features of MNA long-form that distinguish from other tools it used both in community and health care settings. But it is less applicable in some emergency settings (18). It also detects the risk of malnutrition before a severe change in individuals' weight or serum protein occurs (17). Additionally, the lowest MNA long-form score is predictive for mortality and longtime stay in hospital(19).

Also, MNA long-form is validated by various studies in different countries (12, 15, 18, 20-23). It is recommended by the European Society for Parenteral and Enteral Nutrition (ESPEN) for routine geriatric assessments in 2003(7). Still, MNA long-form is recommended as a useful nutritional screening and diagnosis in terms of simplicity, cost, and time-saving for completion(15, 24). Moreover, MNA long-form tool correlates with biochemical markers that are used to assess nutritional status. For instance, it has a significant correlation with serum albumin (12, 13, 17, 18, 20, 23).

Serum albumin is a type of protein that circulates in plasma. The normal range of protein is 6.5-8.5 g/dl. Out of this albumin accounts large percent 50-60% with a normal range 3.5-5 g/dl (25, 26). Serum albumin or plasma albumin can be used for screening malnutrition, but the serum is preferred. Serum albumin in the presence of bromocresol green produces a color complex. The intensity of the color is proportional to the albumin concentration (27). Also, a fasting blood sample is not mandatory but desired to reduce lipidaemia (26). It has a half-life of 20-22 days. Whereas its precursor pre albumin has only 2 to 4 days (28).

Moreover, serum albumin is used as a predictor of morbidity and mortality in elderly people (29). Based on serum albumin concentration in, the nutritional status of elderly people can be classified as malnutrition less 3.0 gram/deciliter (g/dl), at risk of malnutrition 3 to 3.5 g/dl, and above 3.5 to 5 g/dl well-nourished (23, 30, 31). Also, different studies showed that serum albumin concentration can be used as a golden standard to validate MNA long-form (14,19,24).

Even though MNA long-form is validated using different golden standards in a different country, the validity of this tool and it's originally established cut off value in one country is not readily applicable to another country. This because population characteristic varies from country to country especially in terms of anthropometric and nutritional characteristics. For instance, this tool is not applicable for the Chilean population it failed to identify persons at risk of malnutrition(32), and the original cut off value is not applicable for the Irian (20), and Japan (33). So, it is crucial to validated MNA long-form in Ethiopia.

However, MNA long-form is not yet validated for screening malnutrition among the elderly population in Ethiopia. Therefore, this current study was done to validate MNA long-form using serum albumin concentration as a golden standard for screening malnutrition among the elderly population living in the community in Ethiopia.

1.2. Statement of the problem

Globally two persons out of the total population enjoy their 60th birthday every single second. By 2050 elderly people aged 60 and above will be doubled and become the most population need attention throughout the world in this 21st century (34).

In Ethiopia, this population is 3.3 million with urban resident's elders are 4.42 % of the total urban population. Current life expectancy is increased to 67.8 years (2, 35, 36). This age group is affected by the dual burden of malnutrition and chronic non-communicable disease (37). Because of aging and related factor, they are a risk for malnutrition and this makes them different from other human life stages (8, 15). Malnutrition both over and undernourished are serious public health problems irrespectively the country in the elder population (38). The consequence of malnutrition among the elderly population varies from simple to serious outcomes including a long stay in the hospital, cross-infection, and high cost for care, and treatment, in turn, affects the country's economic growth. Even it leads to morbidity, and mortality (6, 37). So it is very important to detect early elderly people who are at risk for malnutrition. This forces the world to have a valid tool for screening malnutrition among the elderly population(8, 15). The nutritional status of elderly people can be screened and assessed by different tools (39). A single measuring tool is unreliable and using simultaneously all is not feasible (15). So it is crucial to validate and use MNA long-form in a developing country like Ethiopia.

MNA long-form is used for screening malnutrition among the elderly population at a different setting. It is the only tool that has four categories(17, 18). Also, MNA long-form is valid and recommended as the best tool for screening, assessing, and intervene malnutrition in elderly population(18).

In the Ethiopia body mass index (BMI) and mid-upper arm circumference (MUAC) has been used to assess the nutritional status of elderly people for a long period. However, in 2016 and 2020 attempt to validate MNA long-form for Ethiopian elders was done(22, 40). But, both these studies have a potential limitation that they use BMI as a golden standard which leads to methodological error since BMI is one component of the MNA tool. Also, BMI is less applicable for obese elderly people(41). Moreover, BMI is not clear-cut of nutritional status because even overweight or obese subjects can be classified as at risk of malnutrition (15).

Hence, this study was done to assess the validity MNA long-form using serum albumin concentration as a golden standard for screening malnutrition among elderly population.

1.3. Significance of the study

Currently, the elderly population is dramatically increasing in the world (1, 2, 5, 34), therefore it is advisable and crucial to organize health programs in all levels of health care that enable the early detection of at risk of malnutrition. In turn, it helps to avert malnutrition and its consequences. Also, improve the elderly population's quality of life.

Various studies have been evaluated the prevalence of malnutrition using the MNA long-form in different clinical settings, showing the excellent acceptability and validity of the tool in all these settings (42-45). Additionally, after 20 years of its introduction, the MNA long-form tool is the golden standard tool for nutritional screening and assessment at all setting including ambulatory community-dwelling elderly people (12). More importantly, it can be completed easily by a physician, a dietician, a nurse, or any trained in a short time less than 15 minutes and it is acceptable to clients (13, 17). Also, this tool has a self-assessment guideline, which helps the elderly people to assess his/her nutritional status by following instructions on guidelines (46). Moreover, the MNA long-form tool not only identifies the nutritional status of elderly people but also favors early nutritional intervention to improve nutritional status and especially improve the quality of life. These in force to validated MNA long-form for early detection and intervene nutritional status of elderly people. So validating this tool in our context has paramount importance. Specifically, validating MNA long-form help study participants to know their nutritional status, better awareness of habit of good nutrition, to take self-intervene based on finding and consequently increase their life expectancy. This study also supports health professionals in early detection, and intervenes appropriately based on finding by validated MNA long-form. Similarly give the direction for governments, program managers, and policymakers in terms of increase their awareness to give priority and attention to screening and assessment nutritional status of the elder population since it is applied in short, easy, and at least cost. Also, this study is a helpful scientific researcher using a result of this study as the baseline.

Because of these all above this study was conducted with the objective validation of MNA long-form for screening nutritional status among the elderly population in Ethiopia.

Chapter two

2. Literature review

2.1. The magnitude of malnutrition among elderly people

The magnitude varies from country to country due to method, tool, subgroup, definition, dietary practice behavior, and area setting. A meta-analysis done in Europe showed that malnourished 28%(44). The multicenter study done in Flanders(Belgium) showed that 19.4 % were malnourished (47). A similar study done in Solvia 42.5% was malnourished(48).

Cross-sectional done in Egypt (Dakahliya) showed that 26.5% were malnourished(49). The study was done in Hyderabad (Shaikpet slum)14.5% was malnourished(43). Similarly, inNepal24.8%(50),in Netherland 17%(45),in India 24.8% (51), in Sri Lanka 12.5% (52),and in Ethiopia 28.3% (22)were malnourished.

2.2. The validity of the MNA long-form tool

Simplicity, reliability, validity, and time-saving are very crucial factor to select screening and assessment tools for malnutrition (15). Out of these crucial factor validity component, MNA long-form sensitivity and specificity, have been assessed by various studies (12, 17, 18, 20-22, 40).

MNA long-form was validated in 2000 among 155 elderly population (23). Since the time of introduction, it has translated in different more than twenty languages and has been used for nutritional assessment with more than two hundred scientific publications(53). Similarly, validity and reliability were assessed by a different scholar in a diverse country and setting (12, 24, 53).

As showed by various study MNA long-form had good diagnostic study when compared to other screening (12, 17, 18, 21, 24). MNA long-form was reliable and showed good internal consistency at first time assessment of reliability with Cronbach's alpha were 0.83 and 0.74 at first and second assessment respectively (21).

Additionally, MNA had various value of sensitivity and specificity study done in Brazil sensitivity 89% and specificity 82% (54),in Japan sensitivity 81% and specificity 86% (33),in Spain sensitivity 85.1 % and specificity 94.2% (21), in Turkey sensitivity 92% and specificity 86% (55). and in Nepal, sensitivity 86% and specificity 67% (41).

Other study in Iran sensitivity 82% and specificity 63 % but original cut off points was not applicable for Irian elders (20) and in South Africa sensitivity 90.8% and specificity 11.2% (56). Moreover, study done in Chile showed that this tool is not applicable for the Chilean population, it failed to identify persons at risk of malnutrition (32).

In Ethiopia, one study was done on MNA long-form showed sensitivity 80.1%, specificity 72.5%, and Cronbach's alpha 0.65 (22). Similarly, another study the MNA long-form showed overall accuracy of 91% (95% CI,87.5%-94.9%),sensitivity 87.9%,specificity 89.6% and Cronbach's alpha 0.7 (40). However, both these studies had a potential limitation that they use BMI as a golden standard which leads to methodological error since BMI is one component of the MNA tool. Also it is not clear-cut of nutritional status and less applicable for obese elderly people.

Therefore, this study was done to validate the MNA long-form using serum albumin concentration as a golden standard for screening malnutrition among the elderly population in Ethiopia.

Chapter three

3. The objective of the study

3..1. General Objective

✓ To validate the mini nutritional assessment (MNA) long-form tool for screening malnutrition among the elderly population aged 60 years and above living in the community, Meki town, East Ethiopia from March 30, to April 30, 2020.

3..2. Specific Objectives

✓ To determine the sensitivity of mini nutritional assessment long-form tool, using serum albumin concentration as a golden standard, for screening malnutrition among elderly people aged 60 years and above living in the community, Meki town, East Ethiopia from March 30, to April 30, 2020.

✓ To determine the specificity of mini nutritional assessment long-form tool, using serum albumin concentration as a golden standard, for screening malnutrition among the elderly population aged 60 years and above living in the community, Meki town, East Ethiopia from March 30, to April 30, 2020.

✓ To determine the internal consistency of mini nutritional assessment long-form tool for screening malnutrition among the elderly population aged 60 years and above living in the community, Meki town, East Ethiopia from March 30, to April 30, 2020.

✓ To determine the optimal cut off value for screening malnutrition using the mini nutritional assessment long-form for the elderly population in Meki town, East Ethiopia.

Chapter four

4. Methods and materials

4.1. Study area and period

The study was conducted in Meki town from March 30 to April 30, 2020. Meki is a town in East-central Ethiopia. Meki town found at 132 kilometers (km) form Addis Ababa, the capital city of Ethiopia. Located in the East Shoa Oromia region, it has a latitude and longitude of 89º N 38 49º E with an elevation of 1636 meters above sea level. Meki is the administrative center of Dugda woreda. The Meki town has 2 health centers,3 urban Kebele with a total population of 44,237(35, 36). The total from house to house census was found to be 1934 and this figure was used for this study.

4.2. Study design

A Community-based cross-sectional validation study was conducted.

4.3. Population

Source Population: All elderly people aged 60 and above years living in Meki town.

Study Population: Randomly selected elderly people aged 60 and above years in Meki town.

4.4. Eligibility criteria

Inclusion criteria

All apparently healthy elderly people aged 60 years and above who have been living in Meki town for 6 months and above were included.

Exclusion criteria

An elderly person who was amputated, bedridden, edematous, have visible of deformity, have known liver and kidney disease were excluded from this study.

4.5. Sampling and sample size

Sample size

Buderer's formula was used for sample size calculation in at the required absolute precision level, the prevalence in the particular study area, sensitivity, and specificity (57, 58).Previous studies reported that the MNA long-form tool has a sensitivity of 96% and specificity of 98% in diagnosing malnutrition among the elderly population using serum albumin concentration as golden standard (53, 59) and an expected 28.3% prevalence of malnutrition using MNA long-form is considered based on a previous study in Ethiopia (22). The maximum difference accepted between estimated sensitivity or specificity (degree of precision) is 4 % for CI 95% (alpha=0.05), considering a nonresponse rate of 10%. The final sample size became 176.

$$N_{sp}=\frac{(Z\alpha/2)^2 x\ Sp(1-Sp)}{w^2\ x\ p}=\frac{(1.96)^2\ x\ 0.98(1-0.98)}{(0.04)^2\ \ ^x(0.283)}=174$$

Corrected for 1934 = $= \frac{n}{1+n/N} = \frac{174}{1+174/1934} = 160$ Total =10% non-response (16) + 160= **176**

Sampling technique

A simple random sampling technique was used to select study subjects. Meki town was selected purposively from other towns in East Shoa, Oromia because of town with a diversified population and the second populated town in the zone. Moreover, this town was selected because there was high in-migration of people from different part of the country for irrigation and other purposes. The sampling frame was developed by the house to house census of elderly people aged 60 years and above was done for each Kebele and code number was given to identify an eligible elderly individual in households. Also, the phone or any means of communication was secured for the next data collection day. The total sample size was allocated proportionally for each Kebele depending on the number of elderly people. Study subjects from each Kebele were selected using the simple random sampling technique.

Sampling procedure

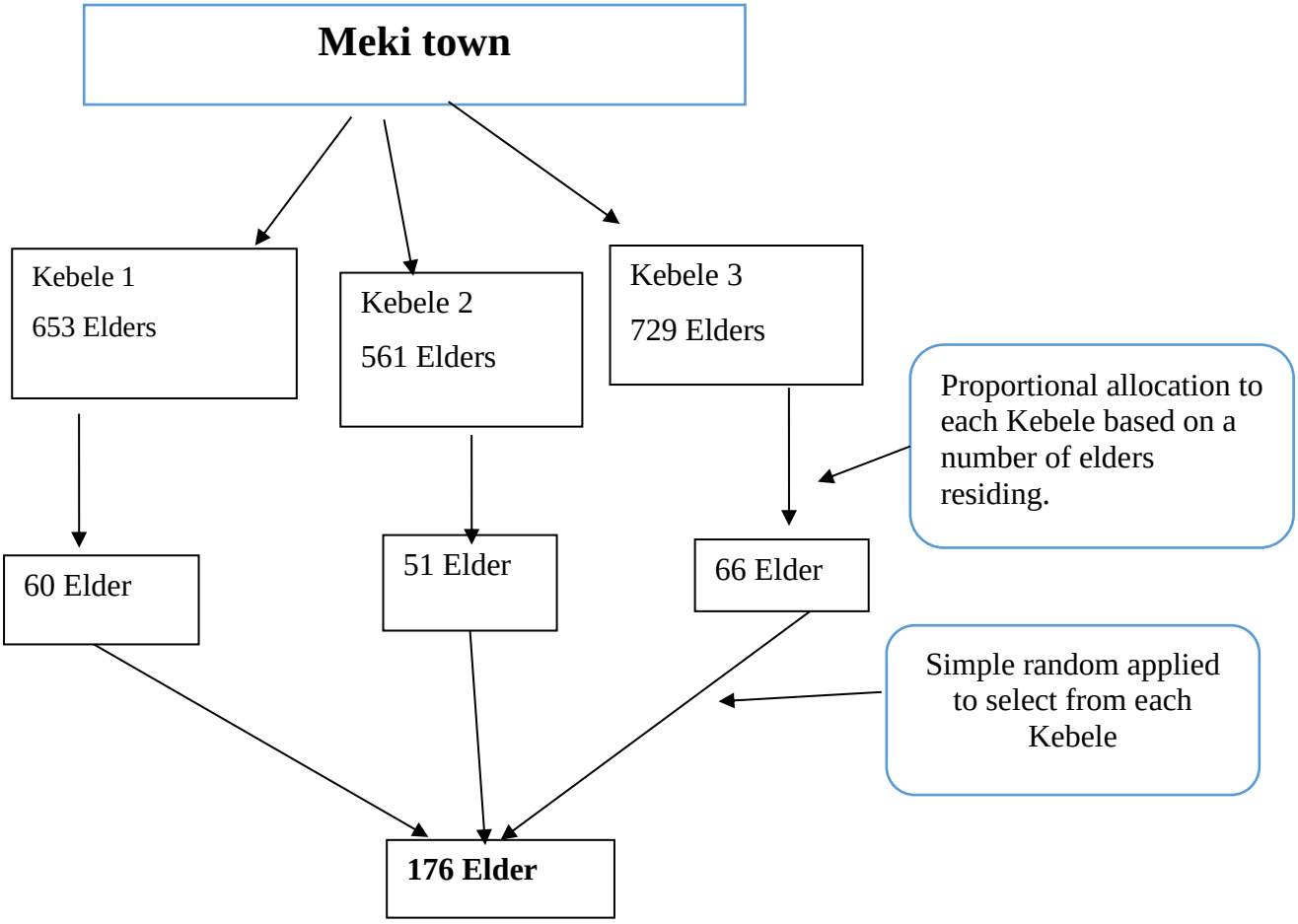

Figure 1: Sampling procedure of study participants from elderly people aged 60 and above years in Meki town, East Ethiopia, 2020.

4.6. Data Collection Procedure and Measurement

Data Collection Procedure

Data collection were carried out using translated and pretested on 5% of the sample size. The Amharic and Afan Oromo version were used after extensive 2 days of training given for data collectors (2 BSc nurse and 2 Laboratory technicians) and supervisors (4 BSc health officers). All MNA long-form questionnaires which adapted from Nestle nutrition institute (14) were administered to all voluntarily participated elderly population.

Elderly individuals were told not to take food, alcohol, and insulin before blood sample collection for serum albumin concentration analysis. Additionally, the elderly were told to restrict himself from consuming food like meat, butter, and cheese within 24 hours of blood collection. However, they were allowed to take adequate amount water.

The blood sample was collected before 9:30 am after a full overnight fast starting from 7:00 pm. The arm was tourniquet above closest to the site of drawn and cleaned with an alcohol swab and allowed to dry. Then fasted venous blood sample from a visible vein was drawn up to 0.5 milliliters (ml)(60) collected using Cupper-free and Zink-free syringe(Monovette, Germany) of a 23-gauge needle (61) and collected in clot tube red-top plain tube without additive(25, 26) from the non-dominant arm by a trained BSc laboratory technician.

After collecting and inverting the tube for 3 pairs, a fasted venous blood sample was allowed to clot for 30 minutes(62)and was centrifuged at 2500 rate per minute for 5minute(61). The tightly stoppered sample was transported for analysis within 2 hours by keeping at room temperature (25 to 35^{o}c)(25, 26). Liquid stable reagent, Bromocresol green (BCG) reagent of 50ml (model0102; 0110901009) with its commercial standard of 3ml per bottle was used for analysis. Both reagents and standards were kept at room temperature (15^{o}c to 25^{o}c) (27).

Only 10 microliters centrifuged fasted venous blood sample was used adding 1ml reagent and 10 microliters standard to analysis. Every step followed the recommended procedure by albumin reagent and standard manufacturer *(Albumin collection procedure*). The analysis was carried out by a BSc laboratory technician using a standard machine (Genus, WP21A).

Anthropometric measurement

Height: Study subjects height was measured and recorded to the nearest 0.1 cm using a stadiometer (Seca 213, Germany) while they were standing upright with leg placed together lane each other, heels, buttocks, shoulders, and head occipital part touching the stadiometer flat board. Each measured twice using the same measuring instruments and finally, the average of the first record and second record was taken as the height of elders (9).

Weight: The weight of study subjects was measured using digital scales (GE, 2003EA) place on a hard flat surface, then it was calibrated to (00.00) and a reliable set of scales was checked with a known 2kg standard weight. The participants were weighed wearing light clots by removing Shoes, Jackets, and recorded to the nearest 0.1kg. Each measurement was measured carried out twice by the same measurement scale and finally, the average of the first record and second record was taken as the weight of elders (9).

MUAC: MUAC was measured at mid-point between the tip of the acromion and olecranon process on the back of the upper arm while subjects forearm held a freely horizontal position recorded nearest 0.1cm. Each was measured twice by adult MUAC tape and finally, the average of the first record and second record was used (9).

CC: CC was measured at the widest circumference between ankle and knee to the nearest 0.1 cm using a flexible tape measure and manipulated to maintain close contact with the skin without pressuring the underline tissues, in a sitting position with leg 90^{o} at the knee and recorded at the nearest 0.1 cm. Each was measured twice by non-stretchable tape and finally, the average of the first record and second record was used (9).

BMI :-Computed as body weight in kilograms / (height in meters $)^{2}$(9).

4.7. MNA long-form items and it's scoring

The MNA long-form is short completed within 10-15 minutes and has 18 items grouped into 4 categories:
Anthropometric assessment part 1: Body mass index, weight loss, mid-upper arm, and calf circumference
General assessment part 2: Mobility, skin ulcer, medication, lifestyle, acute stress, depression
Dietary assessment part 3: Feeding status, loss of appetite, number of meals, intake of food, fruit, and fluid
Self-assessment part 4: Self-perception about nutrition and health status.

All items in categories have an individual which summed to give a total MNA long-form score of maximum 30 points with below 17 points malnutrition,17 to 23.5 at risk of malnutrition, and 24 to 30 well-nourished (9, 14) (*Annex 1: MNA long-form* tool*).*

4.8. Operational definition

Apparently healthy: Elder with good health physical appearance, has no illness and mental problem during data collection (10).

At the risk of malnutrition: Elder person with serum albumin concentration of 3 to 3.5 g/dl(30, 31) or MNA long-form score 17 to 23.5 points (14).

Malnutrition: Elderly person with a serum albumin concentration of less than 3g/dl (30, 31) or MNA long-form score less than 17 points (14).

Well-nourished: Elderly person with a serum albumin concentration of 3.5 to 5 g/dl(30, 31) or MNA long-form score 24 to 30 points (14).

Edematous: Elder person with swelling over any part of the body visible and when touch which shows finger index (63).

Elderly: The age determination used to define 'elderly' varies among researchers. However, this study was used '60 years and over' as the age cut-off to refer to elderly people(1, 2).

Full meal: Meal is considered a full meal if elders eating more than 2 times per day(9).

One Cup of fluid: considered if the elder drink ¼ liter fluid (9).

Severe acute illness: Newly onset illness that affects the elder activity and/or needs hospitalization or needs some intervention (64).

Severe mental problem: Mental problems lasting with elder and affect response to a questionnaire, daily activity at the time of data collection (65).

4.9. Data entry and statistical analysis

The data were entered into Epidata version 3.1(Jens M. Lauritsm, Michael Bruus, 270108), then exported, cleaned, and analyzed by SPSS version 25 (IBM Corp, 64-bit edition, 2017).

Descriptive analysis

Different the variables of interest were described by using means, standard deviations (SD), frequencies, and percent (%). A P-value below 0.05 was used to define statistical significance.

Reliability analysis and interpretation

The overall internal consistency of the MNA long-form for the observed data was evaluated by Cronbach's alpha. For each item in the MNA long-form tool, Cronbach's alpha if the specific item is removed from the scale also calculated. Cronbach's α value of 0.60-0.70 acceptable,0.70-80 adequate and ≥ 80 good (66).

Validity analysis and interpretation

Criterion-related validity is the correlation of a new tool with other measurement parameters, ideally, a golden standard tool that has been used and well-accepted (67). Hence, spearman's rank correlation coefficient between MNA long-form and serum albumin concentration was calculated to assess criterion-related validity. 0.90 -1.00 very high,0.70- 0.90 high, 0.50-0.70 moderate ≤0.50 lower (68).

Also, concurrent validity, a type of criterion-related validity, is the correlation of the new tool with criterion measure both which are given during the same interview (67). Therefore, spearman's rank correlation coefficient between MNA long-form and participant's self-perception of nutritional status was calculated to assess concurrent criterion-related validity.

Cross-tabulation (3x3) was done to assess the inter-method agreement using weighted kappa. Weighted kappa gives credit for each disagreement across the level of categories (67). So the agreement between the MNA long-form and serum albumin concentration was assessed by weighted Kappa value. 0.80-1.0 perfect agree,0.61-0.80 substantial agree,0.41 -0.60 moderate agree,0.21 -0.40 fairly agree ,0.00-0.21 slightly agree and < 0.00 poor (69).

Cross-tabulation (2x2) "markers of malnutrition" versus "well-nourished" was done to calculate sensitivity, specificity, PPV, NP, and total accuracy to assess the diagnostic accuracy of MNA long-form using serum albumin concentration as a golden standard. Markers of malnutrition (merged at risk of malnutrition with malnutrition) defined as MNA long-form total score < 24 points or serum albumin concentration <3.5g/dl.

The optimal cut off value of Sensitivity, specificity, PPV, and NPV depends on the purpose of MNA long-form used whether screening or diagnosis. For screening high sensitivity and NPV while for diagnosis high specificity and PPV (70).

ROC- curve analysis and interpretation

The receiver operating characteristic (ROC) curve generated both empirical (nonparametric) and binormal (parametric assuming a normal distribution) (71). Unlike sensitivity, specificity, PPV, and NPV it evaluated accuracy for all possible cut off value. Plotted the true positive rate (sensitivity) against false positive rate (1-specificity) for all possible cut off value. It gives AUC and Youden's index.

MNA long-form tool's ROC curve plotted using serum concentration level less than 3.5 g/dl as markers of malnutrition. The area under the ROC curve (AUC) was used to assess the overall accuracy of the MNA long-form tool. AUC value 0.9 and above excellent,0.8-0.9 Good 0.7- 0.8 satisfactory and 0.6-0.7 not good(72).

A new optimal cutoff value of the MNA long-form tool was calculated using the Youden's index (Sensitivity + specificity -1). Also, Youden's index is used to compare the proportion of subjects correctly categorized. The higher value the more accurate prediction, higher true positive and true negative, at a defined optimal cut off value. The value of Youden's index 0 indicates the tool useless and value 1 indicate a perfect tool of highest discriminatory power (70).

4.10. Data quality control

Two days of training was given for data collectors and a supervisor on how to conduct the interview and anthropometric measurements. The training was delivered using the Nestle nutrition institute guideline on MNA long-form and WHO guidelines on the standard operating procedure of clinical chemistry for serum albumin collection which developed in 2000(9, 26).

After training data collectors and supervisors were evaluated compared with universal standard procedure. Pretesting and translation questionnaires were done before the actual data collection. A digital scale and stadiometer were calibrated on a hard flat board. The digital weighting scale was validated using known 2kg standardized weight before the actual weighting of the participants.

Before fasted venous blood sample collecting perquisite like 24 hours self-restriction from meat, butter and cheese, fasting, not taking alcohol, insulin drugs and taking adequate water were checked for all subjects. Blood was drawn to the nearest tourniquet site following standard operating procedures and reagent manufacturer instruction (27) . All blood sample collection tube was labeled with code assigned to participants.

All data collectors were allowed to collect only 5 to 6 samples per day. The data were monitored frequently during data collection and collected questionnaires were checked for completeness and consistency during the interview and at the end of each day by all supervisors. All code was rechecked both for blood sample and questionnaires.

Range and logic checks were constructed on computer prior entry especially for age and each item score. Epidata double entry, rechecked the original questionnaire and cleaning were done. At each stage of data entry and analysis, all stage backup copy was used.

4.11. Ethical Clearance

Ethical clearance was obtained from the Ethical Review Committee (ERC) of Jimma University, Institute of Health Science. An official letter of cooperation was taken from ERC and was given to Dugda woreda health departments. Before the interview written consent was obtained from study participants 60 years and above elders. Information was given for elder about the voluntary basis of participation and that they can stop the interview at any time if they are not comfortable. Data collectors and supervisors were assigned based on their workplace and residence in their community and names or personal identifiers were not included in the written questionnaires.

4.12. Dissemination of study findings

The results of the study will be submitted to the Post Graduate School of Jimma University. Furthermore, it will be disseminated to the Dugda woreda health office, East Shoa zone health department, and health facilities through hard/ or softcopies as necessary. Also, the attempt will be made to submit for publication in an appropriate reviewed scientific journal.

Chapter Five

5. Results

5.1. Characteristics of study participants

A total of one hundred and seventy-six elders participated in the study. From this, 44.3% were males. The mean (SD) age of the participants was 67.56(±5.791) years and ranged from 60 to 84 years. About seventy percent of the participants were in the age category between 60 to 69 years. The mean (SD) weight, MNA, and Serum albumin of the participants were 70.72(± 10.15), 20.70 ± 3.46, and 3.68 ± 0.60 respectively (*table 1*).

Table 1: Characteristics of study participants elderly people aged 60 and above years in the community, Meki town, East Ethiopia, 2020

Sex	Male (no, %)	78 (44.3%)
	Female (no, %)	98 (55.7%)
Age category	60 – 64	61 (34.7%)
(year) (no, %)	65 – 69	63 (35.8%)
	70 - 74	24 (13.6%)
	75 -79	23 (13.1%)
	≥ 80	5 (2.8%)
Age(year)(*mean, SD*)		67.56 (5.79)
Weight(Kg)(*mean, SD*)		70.72 (10.15)
Height(meters)(*mean, SD*)		1.70 (0.07)
Serum albumin score(g/dl)(*mean, SD*)		3.68 (0.60)
MNA long-form(sum score) (*mean, SD*)		20.70 (3.46)

In terms of nutritional status, 18.2% and 13.1% elderly population were malnutrition by MNA long-form and Serum albumin concentration level respectively (*figure 2*).

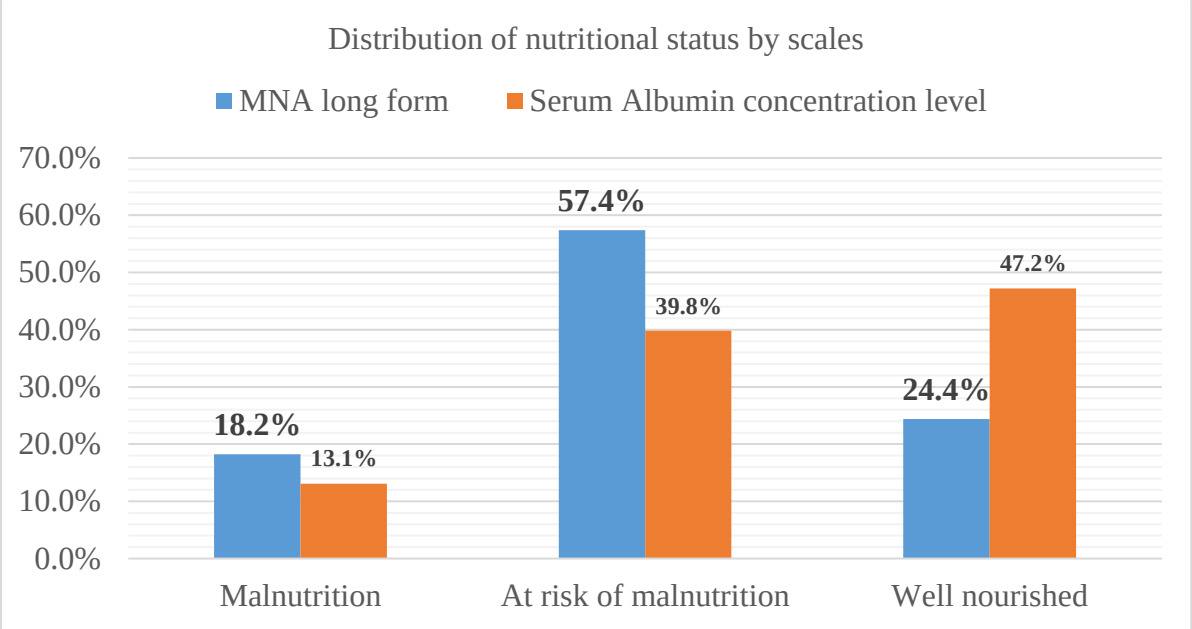

Figure 2: Distribution of nutritional status among study participant's elderly population aged 60 and above years in the community, Meki town, East Ethiopia, 2020.

5.2. Reliability of MNA long-form items

Internal consistency within 18 items of MNA long-form

Overall homogeneity between the eighteen MNA items was adequate with Cronbach's Alpha of 0.605. Cronbach's alpha when an item was removed ranged from 0.526 to 0.633 with the highest improvement observed when the acute stress (item no.4) was removed (0.633) (*table 2*).

Table 2: Cronbach's alpha for the MNA long-form tool applied in the elderly population aged60 years and above in the community, Meki town, East Ethiopia, 2020).

No	Items	Cronbach's alpha if Item Deleted
1.	Decreased food intake	.596
2.	Weight loss	.559
3.	Mobility status	.607
4.	Acute stress	.633
5.	Depression	.599
6.	BMI category	.614
7.	Living without support from other	.591
8.	Number of drug per day	.616
9.	Ulcer on skin	.620
10.	Number of meals	.619
11.	Consumption of protein	.589
12.	Fruit and /or vegetable intake	.565

13.	Fluid intake	.596
14.	Feeding status	.576
15.	Self-perception of nutritional status	.567
16.	Self-perception of health status	.526
17.	MUAC category	.582
18.	CC category	.565
	Overall Cronbach's alpha	***0.605***

MNA long form correlation with every 18 item

The correlation of MNA long-form with every eighteen components by spearman's rank coefficient ranging from 0.01 to 0.70. MNA was significantly correlate with self-perception of health status (*see table 3*)

Table 3 : Spearman's rho for the MNA long-form tool applied in the elderly people 60 and above years in the community, Meki town, East Ethiopia, 2020.

No	Items	Spearman's rho
1.	Decreased food intake	.273
2.	Weight loss	.576
3.	Mobility status	.064
4.	Acute stress	.354
5.	Depression	.242
6.	BMI category	.392
7.	Living without support from other	.341
8.	Number of drug per day	.013
9.	Ulcer on skin	.039
10.	Number of meals	.269
11.	Consumption of protein	.400
12.	Fruit and /or vegetable intake	.529
13.	Fluid intake	.251
14.	Feeding status	.469
15.	***Self-perception of nutritional status***	***.514***
16.	Self-perception of health status	.670
17.	MUAC category	.423
18.	CC category	.529

*All significant at Spearman's rho > 0.242, *P-value* < 0.05

5.3. Validity of MNA long-form tool

The validity of the MNA long-form tool depends on the correlation and agreement between MNA and serum albumin concentration level. MNA long-form tool showed significantly correlated with serum albumin concentration spearman's rho (ρ) 0.746(*table 4).* Similarly, there is moderate agreement in three categories nutritional status cross-tabulation weighted kappa (95% CI) (κw = 0.556(0.470, 0.642) (*table 4*). This both result implies that the criterion-related validity of the MNA long-form tool was significant as compared to serum albumin concentration. Additionally, MNA long-form tool moderately significant in terms of concurrent validity as compared to self-perception nutritional status with correlation coefficient spearman's rho (ρ) 0.514 (*above table 3, no. 15 items*).

According (original cut off point) MNA long-form had sensitivity 93.5 %, specificity 44.6% PPV 65.4% and NPV 86% of MNA long-form. This showed that MNA long-form had good diagnostic accuracy as compared to serum albumin golden standard with a total diagnostic accuracy of 70.45%.

Table 4: Measure of correlation, agreement, and diagnostic test between MNA long-form and serum albumin of participant elderly people aged 60 and above years in the community, Meki town, East Ethiopia, 2020.

Spearman's rho(r_s)	0.746, *P-value* <0.05
3 categories* Weighted kappa (95% CI)	0.556(0.470,0.642)
2 categories** Weighted kappa (95% CI)	0.391(0.269,0.514)
Sensitivity	93.5%
Specificity	44.6%
PPV	65.4%
NPV	86.0%
Total Diagnostic accuracy	70.45%

3 categories* = malnutrition, risk of malnutrition, well-nourished
2 categories **= "malnutrition and risk of malnutrition", well-nourished

5.4. MNA long-form's ROC-curve finding

The ability of MNA long-form to identify the markers of malnutrition (i.e. merged at risk of malnutrition and malnutrition) comparing well-nourished was assessed using the area under ROC-curves. The area under ROC curves using the serum albumin concentration as golden standard the area under curve(AUC) showed the highest values 0.927 (*figure 3*).The AUC (95% CI) value indicates that MNA had excellent diagnostic accuracy to diagnosis malnutrition with overall accuracy of 92.7 % (88.5, 96.9).

Maximum Youden's index point calculated using ROC curve was found to be 0.804. At this Youden's index value, the newly developed optimal cut off value for MNA long-form tool was 20.5 to markers of malnutrition. Based on this new optimal cut off value, MNA long-form total score < 20.5 points classified as markers of malnutrition. At this optimal cut off value sensitivity increased to 97.6% and specificity increased to 82.8%. The new cut off value brings sensitivity and specificity much higher than the original established cut off value. Again, MNA long-form showed very good diagnostic accuracy as compared to serum albumin concentration. This implies the original established cut off value need modification for our country.

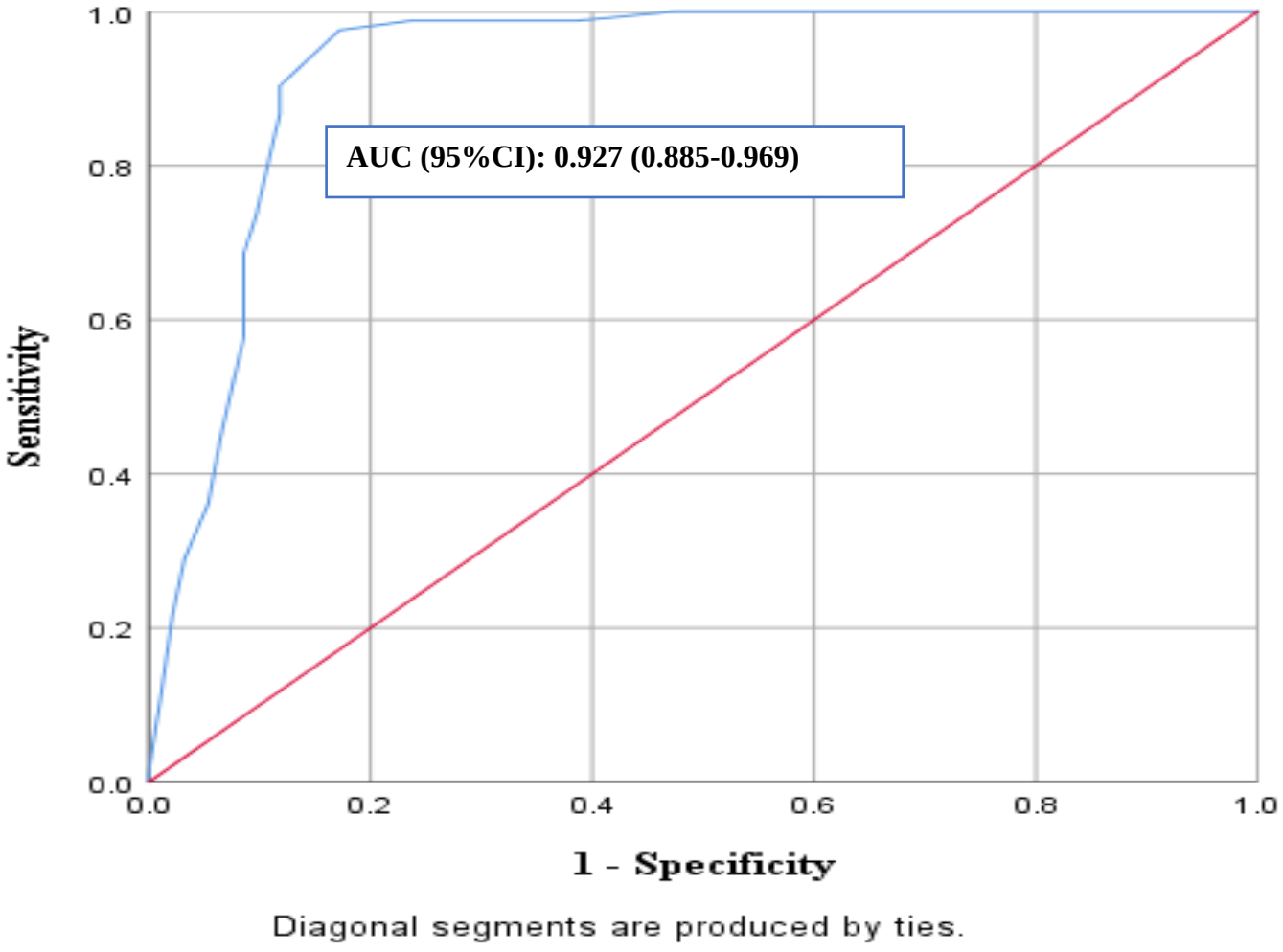

Figure 3: The ROC curves of one hundred and seventy-six samples for the MNA long-form tool as compared to serum albumin of participant elderly people aged 60 and above years in the community, Meki town, East Ethiopia, 2020.

Chapter Six

6. Discussion

6.1. Result Summary

In this study, the MNA long-form had adequate predictive ability of markers of malnutrition with respect to the serum albumin concentration among elderly population living in the community. It showed high sensitivity and specificity with modified optimal cut off value. According original cut off value, it presented a sensitivity of 93.5%, a diagnostic accuracy of 70.45% with overall diagnostic accuracy 92.7% as compared to serum albumin concentration.

Also, the MNA long-form demonstrated the validity of the optimal cut off value of 20.5 for MNA long-form using the serum albumin concentration <3.5g/dl as a golden standard. This optimal cut off value had a sensitivity of 97.6% and specificity of 82.8%.

Additionally, the MNA long-form showed a strong agreement with serum albumin concentration for identifying elderly individuals with malnutrition or those at risk of malnutrition (weighted kappa= 0.556 (0.470, 0.642). As compared to the golden standard, the MNA long-form was over estimate malnutrition by 5.1 %. Prevalence of malnutrition using serum albumin concentration was found to be 13.1%.

6.2. Comparison with existing literature

In this study, the MNA long-form had acceptable internal consistency within its eighteen items of Cronbach's alpha value 0.605. Also, in this study MNA long-form showed significant correlated with serum albumin concentration of Spearman's rho (r_s) 0.746. Additionally it had significant correlation with self-perception nutritional status of Spearman's rho (r_s) 0.514. These both finding implies criterion related validity and its subtype concurrent validity were significant. Moreover, MNA long-form tool had a moderate agreement with serum albumin concentration level of weighted kappa 0.556.

According the originally established cut off value, the MNA long-form had a sensitivity of 93.5% and specificity of 44.6% with the positive predictive value of 65.4% to predict at risk of malnutrition or malnutrition. This means most of the elderly correctly identified as malnutrition. Also, in this study MNA long-form showed an excellent overall diagnostic accuracy of 92.7%.

In the current study, MNA long-form showed comparable sensitivity with a study done in Turkey that had a sensitivity of 92% (55). Whereas, MNA long-form showed lower than the original developers of sensitivity 96% and specificity 98%(59).This may due to the variation in setting and used golden standard to validate MNA long-form.

However, this study showed higher sensitivity as compared to study done in Spain sensitivity 85.1 % (21), Iran with sensitivity 82 % (20), Brazil with sensitivity 89% (54), Japan sensitivity 81% (33),Nepal sensitivity 86%(41). However, in this study MNA long-form had higher both sensitivity and specificity as compared to the study done in South Africa with sensitivity 90.8% and specificity 11.2 % (56). The variation in sensitivity and specificity may due to the setting and selection of the golden standard to validate the MNA long-form.

Even though no literature supports the tool with higher sensitivity and lower specificity like in this study high sensitivity of 93.5% and lower specificity of 44.6%. However, in practice, this means the tool is likely to have a more false-positive case than false-negative cases. This in term of socio-economic the tool will save time, cost, and intervention attention to elderly people who have been falsely diagnosed as malnutrition. Hence, this study supports the use of MNA long-form as an accurate and sensitive tool for screening malnutrition among elderly population living in the community.

In this study, using the newly developed optimal cut off points for MNA long-form score of <20.5 (at Youden's index maximum 0.804) to detect markers malnutrition sensitivity increased to 97.6% and specificity increased to 82.8%. According to new optimal cut off value the MNA long-form showed very good diagnostic accuracy of 80.4%. Here, it demonstrated comparable sensitivity and specificity to original developer (60).

Hence, based on both original and newly developed optimal cut off value MNA long form was a valid tool for screening malnutrition among elderly population in Ethiopia. However, the new cut off value brings sensitivity and specificity much higher than the original cut off points. Therefore the original MNA cut off value needs modification for screening malnutrition among elderly population living in the community in Ethiopia.

6.3. Current study implications for research and/or practice

Currently the elderly population is gradually increasing in this 21st century with the double rate 11.1% to 22% (1, 34, 35). Because of this, time-saving, inexpensive, fast, and simple nutritional screening and assessment tools are very crucial to use at any level of nutritional screen and assessment. Therefore, MNA long-form is a useful screening and valid tool but the characteristics of the population must considered to make nutritional status screening and assessment based on this tool. This tool save the life, time, and cost of health expenditure. It saves life by early detection of at risk for malnutrition, thus averting malnutrition and its consequences. In turn, it will improve the quality of life for the elderly population. Also it does not require laboratory investigation, so it is recommended to be used in resource scarce area and for research setting.

Moreover, because the magnitude of malnutrition is not very high in the elderly population the inter-method/tools agreement between the MNA long-form and serum albumin concentration level on identify the elderly people those need intervention attention will be fair to moderate. So completion of the MNA long-form tool important with the supplement of field expert view.

6.4. Strengths and limitations of the current study

Limitation

- In this study, although considered as mini Ethiopia, only one study area was used to validate.
- Re-call bias because of age related memory loss.
- Other limitation is only one golden standard tool to validate MNA long-form.

Strength

- Using biochemical markers as golden standard to validate MNA long form.
- This study done on elderly population living in the community using simple random sample, after developing sampling frame by house to house census of elders, to select study participants. This helps to control the confidence interval for both sensitivity and specificity of MNA long form. Moreover, it increases the generalizability of this study finding.

Chapter Seven

7. Conclusions and Recommendation

7.1. Conclusions

In general, in this study MNA long-form had a good discriminatory ability to identify malnutrition. MNA long-form is a reliable and valid tool for screen and assessment malnutrition among the elderly population in Ethiopia. However, it overestimates as compared to the golden standard. In terms of socio-economic, it save the life, time, cost, and intervention attention to elderly people who have been falsely diagnosed as malnutrition.

7.2. Recommendation

For governments, program managers and policymakers

MNA long-form is a short, inexpensive, and valid tool for screen malnutrition among elderly population living in the community in Ethiopia. Using MNA long-form will save the country's economic loss due to malnutrition and its consequence. So I recommend being the part health program as the best tool used in routinely screening malnutrition at different levels.

For health professionals

MNA long-form is a short, simple, and time-saving tool that used to assess at times four class of problems including mental problems which highly affect the health status of the elderly population, so I suggest you use this tool in your routine elderly population care.

For researchers

Future study would be needed in order to better see the predictive ability of MNA for screening malnutrition among elderly population living in the community using combined biochemical markers.

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Annexes

Annex 1: MNA long-form tool

Mini Nutritional Assessment
MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) (weight in kg) / (height in m²)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐
12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished

For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day yes ☐ no ☐
- Two or more servings of legumes or eggs per week yes ☐ no ☐
- Meat, fish or poultry every day yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score
24 to 30 points ☐ Normal nutritional status
17 to 23.5 points ☐ At risk of malnutrition
Less than 17 points ☐ Malnourished

References
1. Vellas B, Villars H, Abellan G, *et al.* Overview of the MNA® - Its History and Challenges. *J Nutr Health Aging.* 2006; **10**:456-465.
2. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). *J. Geront.* 2001; **56A**: M366-377
3. Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us? *J Nutr Health Aging.* 2006; **10**:466-487.

For more information: www.mna-elderly.com

Annex 2: Standard operating procedure (SOP)

Title 1: Measurement of Height

Purpose: Accurate height measurement is important in the clinical research setting. All were required to use a wall mounted stadiometer. Participant's standing height was the distance from the soles of the feet to the top of the head with the participant standing erect and looking straight ahead. The measurement of height is recorded in centimeters.

S,no	Procedure:	Yes	No
1.	Standing height is measured with a fixed stadiometer with a vertical backboard and a moveable headboard.		
2.	Identify the subject and explain the procedure.		
3.	Have the elder remove head hut		
4.	Ask the subject to remove shoes.		
5.	Have the participant stand on the floor with the heels of both feet together and the toes pointed slightly outward. Body weight is evenly distributed and both feet are flat on the floor.		
6.	Check the position of the heels, buttocks, shoulder, and the occipital part for contact with the vertical backboard. It may not be possible for some subjects to place their heels, buttocks, scapulae and the posterior aspect of the head against the backboard while maintaining normal stature. Subjects are positioned so that only the heels and buttocks are in contact with the vertical board, and the body is positioned vertically above the waist.		
7.	Align the participant's head in the Frankfort horizontal plane (the horizontal line from the ear canal to the lower border of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard.		
8..	Arms should hang free at the sides with palms facing the thighs		
9.	Measurer's eyes should be level with the headboard. Measurer should stand on a stool/ladder if the subject is taller.		
10.	Lower the head board and instruct the participant to take a deep breath and stand as tall as possible. Subject should look straight ahead, take a deep breath, and hold that position while the horizontal headboard is brought down firmly on top of the head.		
11..	Position the head board firmly on top of the head with pressure to compress the hair		
12.	The measurement is recorded to the nearest 0.1cm.		
13.	Repeat for a total of two measurements and record average		

Key :> =11 procedure (>=80%) ➔pass < 11 procedure (<80%) ➔fail need re training over view and re test

Title 2: Measurement of weight

Purpose: Accurate weight measurement is important in the clinical research setting. Actual weight and body measurements was collected for purposes of assessing growth, body fat, and for comparison with reference data. Participant's weights are also used to calculate drug dosages for study medications.

S,no	Procedure:	Yes	No
1.	Weight is measured with a calibrated, electronic digital scale or beam balance.		
2.	Identify the subject and explain the procedure.		
3.	The electronic scale should be in the kilogram or pound mode as per protocol.		
4.	Place a clean paper towel on the scale foot stand. Zero the scale.		
5.	The digital readout should show 000.00 before weighing a sampled person. If it does not, press the zero key on the scale to zero the scale and beam balance in neutral position.		
6.	Ask subject to remove slippers/shoes and any other articles of clothing or jewelry. Subject should be in minimal underclothing and gown only or street clothes as indicated in protocol. Wedding rings and eyeglasses are permitted. Subjects should be weighed with the exact same items on for subsequent measurements.		
7.	Sometimes a metabolic weight may be required. For the metabolic weight, weigh the gown separately and subtract the weight of the gown from the weight displayed on the scale.		
8.	Subjects should be weighed at the same time of the day, if possible, after voiding.		
9..	Ask subject to step onto the scale; stand in the middle of the platform, with his/her head erect and eyes looking straight. The subject should stand still with weight evenly distributed on both feet		
10.	Read and record the weight accurately to the nearest 0.1-kg.		
11	Repeat for a total of two measurements and record average		
Total			

Key

Answer 8 and above procedure (>=80%)➔ Pass

Answer less than 8 procedure (<80%)➔ Fail need re training over view and re test

Title 3: Measurement of blood sample

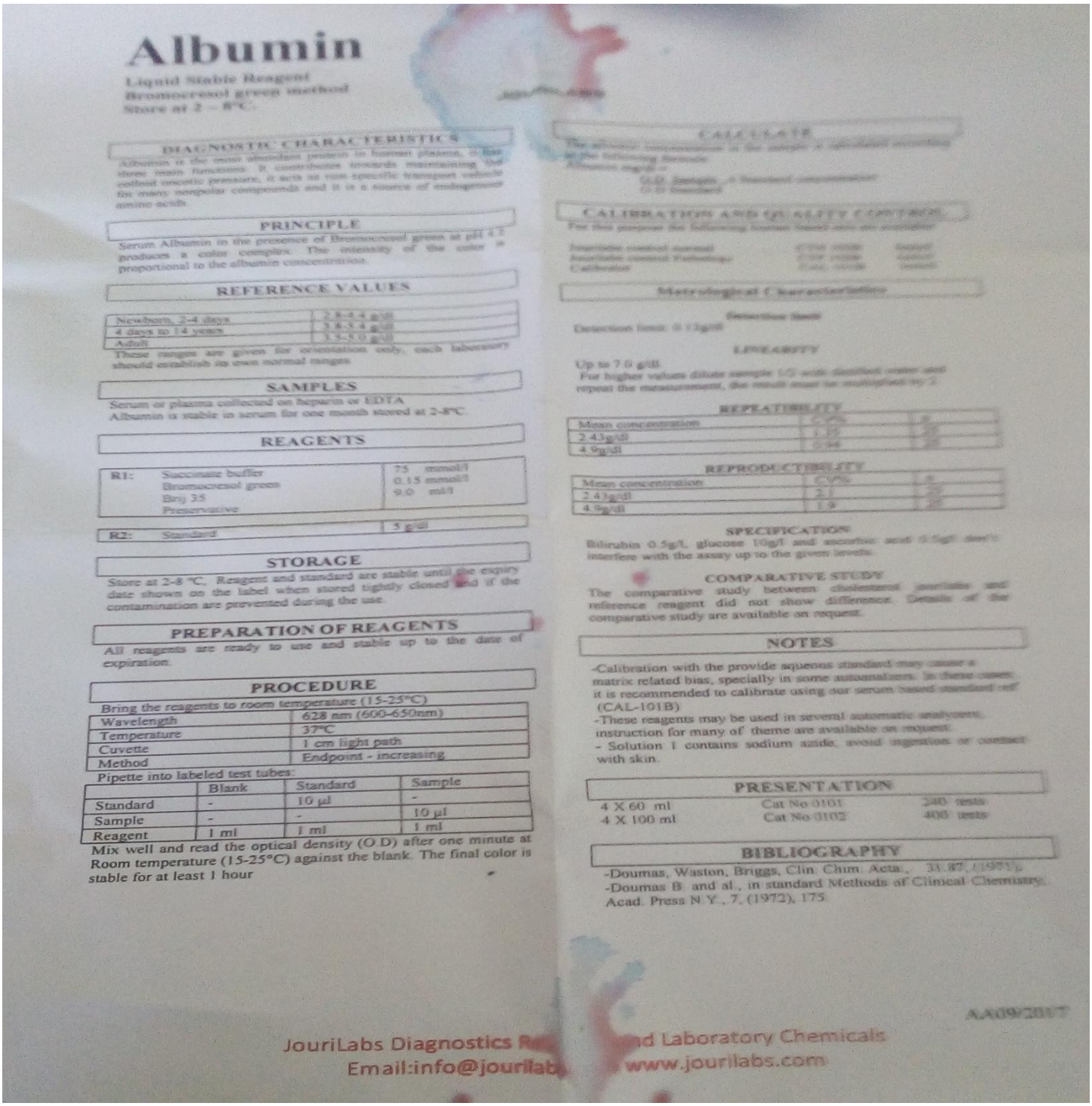
Purpose: Accurate serum albumin measurement is important in the clinical research setting. All were required to use a Cu- free and Zn-free of 23 gauge needle syringe and red top without additive. The measurement of blood sample is recorded in milliliter

S,no	Procedure:	Yes	No
1.	Blood is collected at sitting on comfortable position.		
2.	Identify the subject whether the elder is fasted or not, and explain the procedure.		
3.	Have the elder remove any tight from non-dominant arm		
4.	Ask the subject to be relaxed.		
5.	Check the tube, syringe and needle type.		
6.	Follow any instruction or comment participants concerned.		
7.	Verify the elders and label the tube.		
8.	Site to drawn cleaned and dry		
9.	Arms should tourniquet to nearest to site drawn		
10.	Blood drawn slowly in gentle smooth ways		
11.	Specimen color checked to be clear		
12.	Tube is tightly stoppered		
13.	Blood allowed to clot completely for 30 minutes		
14	Specimen centrifuged for 5 minutes at 2500 rpm		
15	Specimen sent at room temperature for analysis		
16	Analysis followed the instruction given reagent and its standard manufactures		

Key :> =13 procedure (>=80%) ➔ pass < 13 procedure (<80%) ➔fail need re training over view and re test

Albumin collection procedure

Every manufacturer has its own product description and this is Jourilabs product description for serum albumin reagent and its standard description. It include: sample, collection, storage, procedure, and analysis.



Albumin

Liquid Stable Reagent
Bromocresol green method
Store at 2 – 8°C.

DIAGNOSTIC CHARACTERISTICS

Albumin is the most abundant protein in human plasma. It has three main functions. It contributes towards maintaining the colloid oncotic pressure, it acts as non-specific transport vehicle for many nonpolar compounds and it is a source of endogenous amino acids.

PRINCIPLE

Serum Albumin in the presence of Bromocresol green at pH 4.2 produces a color complex. The intensity of the color is proportional to the albumin concentration.

REFERENCE VALUES

Newborn, 2-4 days	2.8-4.4 g/dl
4 days to 14 years	3.8-5.4 g/dl
Adult	3.5-5.0 g/dl

These ranges are given for orientation only, each laboratory should establish its own normal ranges

SAMPLES

Serum or plasma collected on heparin or EDTA
Albumin is stable in serum for one month stored at 2-8°C

REAGENTS

R1:	Succinate buffer Bromocresol green Brij 35 Preservative	75 mmol/l 0.15 mmol/l 9.0 ml/l
R2:	Standard	5 g/dl

STORAGE

Store at 2-8 °C. Reagent and standard are stable until the expiry date shown on the label when stored tightly closed and if the contamination are prevented during the use.

PREPARATION OF REAGENTS

All reagents are ready to use and stable up to the date of expiration.

PROCEDURE

Bring the reagents to room temperature (15-25°C)	
Wavelength	628 nm (600-650nm)
Temperature	37°C
Cuvette	1 cm light path
Method	Endpoint - increasing

Pipette into labeled test tubes:

	Blank	Standard	Sample
Standard	-	10 µl	-
Sample	-	-	10 µl
Reagent	1 ml	1 ml	1 ml

Mix well and read the optical density (O.D) after one minute at Room temperature (15-25°C) against the blank. The final color is stable for at least 1 hour

CALCULATE

CALIBRATION AND QUALITY CONTROL

Metrological Characteristics

LINEARITY

Up to 7.0 g/dl.
For higher values dilute sample 1/2 with distilled water and repeat the measurement, the result must be multiplied by 2.

REPEATABILITY

Mean concentration	CV%	n
2.43g/dl	1.0	20
4.9g/dl	0.94	20

REPRODUCTIBILITY

Mean concentration	CV%	n
2.43g/dl	2.1	20
4.9g/dl	1.9	20

SPECIFICATION

Bilirubin 0.5g/L, glucose 10g/l and ascorbic acid 0.5g/l don't interfere with the assay up to the given levels.

COMPARATIVE STUDY

The comparative study between cholesterol jourilabs and reference reagent did not show difference. Details of the comparative study are available on request.

NOTES

-Calibration with the provide aqueous standard may cause a matrix related bias, specially in some autoanalyzers. In these cases, it is recommended to calibrate using our serum based standard set (CAL-101B)
-These reagents may be used in several automatic analyzers, instruction for many of theme are available on request.
- Solution 1 contains sodium azide, avoid ingestion or contact with skin.

PRESENTATION

4 X 60 ml	Cat No 0101	240 tests
4 X 100 ml	Cat No 0102	400 tests

BIBLIOGRAPHY

-Doumas, Waston, Briggs, Clin. Chim. Acta., 31, 87, (1971).
-Doumas B. and al., in standard Methods of Clinical Chemistry, Acad. Press N.Y., 7, (1972), 175.

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Email:info@jourilab... www.jourilabs.com

Annex 3: Consent and questionnaires

Overview Study Information sheet, consent form and questionnaires for elderly people

Study Information Sheet.

Dear respondent my name is _____ I am going to interviewing elder aged 60 and above in order to generate information necessary for the planning appropriate interventions to promote the nutritional status of elders. To attain this objective, your honest and genuine participation by responding to the question prepared is very important and highly appreciated. I will proceed to the interview after you understand the following points

Objective: To assess the validity and reliability of mini nutritional assessment long-form among elderly people living in community, Meki Town.

Benefit: The study may not directly benefits the participants to know their status, the information generated for the help policy makers and health care professionals for designing appropriate intervention.

Harm: The study may only have minor harm (swelling and bleeding injection site) to subject.

Duration of the study: The study was conducted for 1 month.

Duration of the interview: The interview may take 15-25 minutes

Confidentiality: I am going to ask some questions that you may find it difficult to answer. Your answers are completely confidential. Your name will not be written in this form and will never be used in connection with any information you tell us. All information given by you was kept confidential. Are you willing to participate in this study? 1. Yes 2. No

Consent form (English version)

I have read this form or it has been read to me in the language that I understand. I understand all conditions stated above. Therefore, I am willing to participate in this study. Signature_____

Name of investigator: Megersso Urgessa Address: email megurgessa@gmail.com tell: ***0917562088*** sign: __

Name of interviewer_____ Signature_____

Name Supervisor_____Signature_____

Date of interview: Date_____ Month_____ Year _____Time start. _____end: ____

Questionnaire (English Version)

Part I :Basic questions (encircle and fill)		**Score**
100	Sex 1. Male 2. Female	
101	Age _____ Years	
Part II :Anthropometric measurements		
102	**Weight** 1st _____ kg 2nd _____ kg Average _____ kg	
103	**Height** 1st _____ cm 2nd _____ cm Average _____ cm	
104	**MUAC** 1st _____ cm 2nd _____ cm Average _____ cm	
105	**Calf circumference** 1st _____ cm 2nd _____cm Average _____ cm	
Part III: MNA tool complete by fill appropriate numbers.		
106	**Has decreased food intake within the last 3 months because of loss of appetite, chewing or swallowing difficulty?** 0 = Severe decrease in food intake 1 = Moderate decrease in food intake 2 = No decrease in food intake	
107	**Does your weight loss within the past 3 months without trying to lose and how much weight you lost within 3 past three months?** 0=Weight loss > 3kg 1=Do not know 2=Weight loss 1 to 3kg 3=No weight loss	
108	**How do see your current mobility?** 0=Bed or chair bound 1= Get out of bed/chair but does not go out 2= can go out	
109	**Have you stressed or severe acute disease within the Past 3 months**? 0=Yes 2=No	
110	**Do you have long period or severe sadness?**0 = depression 1 = Mild dementia 2 = No problems	
111	**BMI (Kg/ m2)** 0 = BMI < 19 1 = 19 < BMI <21 2 = 21< BMI< 23 3 = BMI ≥ 23	
112	**Are you living without other support?** 1 = Yes 0 = No	
113	**Are you taking more 3 drugs per day?** 0 = Yes 1 = No	
114	**Do you have a wound over your skins?** 0 = Yes 1 = No	
115	**Do you always eat breakfast, lunch and dinner?** 0=1meal 1=2 meals 2=3 meals	
116	**Question related to selected protein (if yes 0 or 1= 0, if yes 2 =0.5, if yes 3 =1)** Do you consume one glass of milk, and or one cup of yogurt daily? 1. Yes 2. No Do you eat beans or eggs 2 or more weekly? 1. Yes 2. No Do you eat Meat or fish every day 1.Yes 2.No	
117	**Do you consume 2 or more piece of fruit or vegetables daily?**0=No 1=Yes	
118	**How many cups of fluid (water, juice, coffee, tea, milk) do you drink daily?** 0.0 = < 3 cups 0.5 = 3 to 5 cups 1.0 = >5 cups	
119	**Are you able to feed by yourself?** 0 = Unable to eat without assistance 1 = Self-fed with some difficulty 2 = Self-fed without any problem	
120	**How do you describe your nourishment status?** 0 = Views self as being malnourished 1=Is uncertain of nutritional state 2 = Views self as having no nutritional problem	
121	**How do you describe your health status compared with other of the same age?** 0.0 = Not as good 0.5 =Does not know 1.0 =As good 2.0 =Better	
122	**MUAC in cm** 0.0 = MUAC < 21 0.5 =21 <MUAC <22 1.0 = MUAC >22	
123	**CC in cm** 0 = CC <31 1 = CC ≥31	
Total MNA score		
Serum albumin		

የጥናቱ አጠቃላይ መረጃ፡የፈቃደኝነት መጠየቂያ እናቃለመጠይቅ (የአማርኛ ትርጉም)
የጥናቱ አጠቃላይ መረጃ

ጤና ይስጥልን ስሜ_____ይባላል።የጥናቱ መረጃ እየሰበሰብኩ ነዉ።የአረጋዊያንን አመጋገብ በተመለከተ እድሜያቸዉ 60 ዓመት **ና**በላይ ለሆኑ አረጋዊያን ቃለመጠይቅ እያደረኩ ነዉ ይህ መረጃ ዉጤታማ እርምጃዎችን ለመዉሰድ ና የተሻለ አመጋገብ ዓመት እንዲኖራቸዉ ለማድረግ ያስችላል። ይህ ለማሳካት የእርስዎ ተሳትፎ በጣም ትልቅ አስተዋጽኦ አለዉ። ለምንጠይቀዎት ጥያቄ እዉነተኛ ምላሽ ስለሰጡን ከፍተኛ አድናቆት ና ምስጋና ከወድሁ አቀርባለን።የሚከተሉትን ነጥቦች በተገቢዉ መንገድ ከተረዱ በኋላ ወደ መጠይቁ እንሄዳለን

የጥናቱ ዓላማ: በመቂ ከተማ የሚኖሩ አረጋዊን ለይ የአመጋገብ ሁኔታን ሊለካየሚችል መለኪያ መስፈርት ትክክለኛነቱን ማረጋገጥ ነዉ።

የሚገኝ ጥቅም: የጥናቱ ተሳታፊዎች ቀጥተኛ የሆነ ጥቅም አይኖራም። ነገር ግን የሚገኘዉን መረጃ የፖሊሲ አዉጭዎች፤የጤና ባለሙያዎችና ሌሎችም መረጃዉን ለአረጋዉን ከአመጋገብ ጋር ተያይዞ ላሉችግሮች እንደ መፍትሄ ይጠቀሙበታል።

የሚደርስጉዳት -የተሳተፉ ደንበኞች ስለ ተሳተፉ ቃለል (እብጠት እና ደምመፍሰስ) ጉዳትያደርሳል።

ጥናቱ የሚወስደዉ ጊዜ: ጥናቱ የሚካሄደዉ 1 ወር ነዉ.

ቃለ መጠይቁ የሚወስደዉ ጊዜ- ቃለ መጠይቁ ከ 15 እስከ 25 ደደቂቃ ሊወስድ ይችላል።

ሚስጥር መጠበቅ: በመጠይቁ ላይ ብዙ ጥያቄዎችን ሊመልሱ ይችላሉ። ነገር ግን ለሚሰጡት መልስ ሚስጥራዊነት የ ተጠበቀ ነዉ።የእርስዎ ስም በዚህ ፎርም ላይ አይጻፍም ። ከዚህም ሌላ ከመረጃዉ ዉጭ የእርስዎ ማንነት ከጥናቱ ጋር ምንምዓይነት ግንኙነትአይኖረዉም። ስለዚህ እርስዎ የሚሰጡን መረጃ ሙሉ በሙሉ ሚስጥራዊነቱ የተጠበቀለዚህጥና ትእርስዎፈቃደኛነዎት? 1. አዎ 2. አይደለሁም

Consent form (Amharic version)

የፈቃደኝነት መጠየቂያ ቅጽ

እኔ በሚገባኝ ቋንቋ ሃሳቡ ተነቦልኛል ወይም አንብቤዋለሁ. በዚህም መሰረት የጥናቱ ሃሳብና ዓላማ በሚገባ ተረድቸወለ ሁ። ስለዚህበዚህም ቃለ መጠይቅ ለመሳተፍ ፈቃደኛ ነኝ።ፊርማ _____

የተመራማሪዉ ስም: መገርሶ ኡርጌሳ**አድራሻ:**megurgessa@gmail.comስልክ ቁጥር **09-17-56-20-88** ፊርማ _

የጠያቂዉ ስም _____**ፊርማ**_____

የሱፐርቫይዘር ስም_____ ፊርማ_____

ቀን_____ወር_____ዓ. ም_____የተጀመረበት ሰዓት_____ያለቀበት_____

Questionnaire (Amharic version)

ክፍል I፡- የማህበራዊ መጠይቅ		
100	**ጸታ** 1.ወንድ 2. ሴት	
101	**እድሜወት ስንት ነዉ?** _____	
ከፍል II፡- የሰዉነት ልኬታዎች (እባኮትን ሁለት ጊዜ ይለኩ)		
102	**ክብደት:**የመጀመሪያ_____ ኪ. ግሁለተኛ_____ኪ.ግ. ግአማካይ_____ ኪ. ግ	
103	**ቁመት:**የመጀመሪያ _____ሴ. ሜሁለተኛ_____ ሴ. ሜአማካይ _____ሴ. ሜ	
104	**የመሃል ክንድ ልኬታ:**የመጀመሪያ ____ሴ. ሜሁለተኛ____ ሴ. ሜአማካይ ___ሴ. ሜ	
105	**የባት ልኬታ:**የመጀመሪያ _____ሴ. ሜሁለተኛ _____ሴ. ሜአማካይ ___ሴ. ሜ	
ክፍል III ፡-የአረጋዊያንን የአመጋገብ ሁኔታ የሚዳስስ መጠይቅ		
ተ.ቁ	**መጠይቅ**	**ነጥብ**
106	**ላለፉት 3 ወራት በምግብ ፍላጎት መቀነስ ወይም በሌላ ምክንያት የሚወስዱት የምግብ መጠን ቀንሶ ያዉል?**0 =1ከፍተኛ 1 = መካከለኛ 2=ምንም መቀነስ አይታይም	
107	**ያለ ፍላጎት ላለፉት 3 ወራት ክብደት ቀንሶያዉል?** 0=ከ3ኪሎበላይቀነሰ 1=አላዉቀዉም 2=የክብደትመቀነስከ 1-3 ኪሎ 3 =ምንም የክብደት መቀነስ የለም	
108	**የእንቅስቃሴ ሁኔታ ምን ይመስላል?**0=የአልጋ ቁራኛ 1=ከአልጋ መነሳት እችላለሁ ግን ወደ ዉጭ መዉጣት አልችልም 2 = ወደ ዉጭ መዉጣት እችላለሁ	
109	**ላለፉት 3 ወራት ስነ- ልቦ ና ጭንቀት ወይም ህመም ገጥሞዎት ያዉቃል?**0= አዎ 2= አይ	
110	**የአእምሮ እና የስነልቦናች ግሮች አሉ?** 0=ከፍተኛ የሆነድብርት 1 = መካከለኛ የሆነ አእምሮ መሳት 2 = ምንም የአእምሮ ችግር የለም	
111	**ክብደት ለቁመት በካሬሜትር (BMI)** 0 = < 19 1 = 19-21 2= 21 -23 3 = ≥ 23	
112	**ያለምንም እገዛእ እራስዎን ችለዉ እየኖሩ ነዉ?**0 = አይደለም 1 =አዎ	
113	**በቀን ከ3 በላይ የታዘዘ መድሃኒት ይወስዳሉ?** 0 = አይደለም 1 =አዎ	
114	**በቆዳዉ ላይ ቁስል አለ?** 0 = አይደለም 1 =አዎ	
115	**በቀንቁርስ,ምሳ እና እራት ወይም ምግብ ስንት ጊዜይ መገባሉ?**0 =1ጊዜ 1=2ጊዜ 2=3ጊዜ	
116	**የተመረጡ የገንቢ ምግቦች (0=0 ወይም 1 አዎከሆነ 0.5=2 አዎከሆነ 1=3 አዎከሆነ)** በቀን አንድ ጊዜ የወተት ተዋጽኦ ይመገባሉ? 1.አዎ 2. አይደለም በቀን 2 እና ከዚያ በላይ እንቁላል ወይም ጥራጥሬ ይመገባሉ? 1.አዎ2. አይደለም ስጋ፣አሳ በያ ቀኑ ይመገባሉ? 1.አዎ 2. አይደለም	
117	**በቀን 2 እና ከዚያ በላይ አትክልትና ፍራፍሬ ይመገባሉ?** 0.አልመገብም 1.አዎ	
118	**በቀን ምን ያክል ፈሳሽ (ዉሃ፣ወተት፣ጁስ)ብርጭቆ ይጠጣሉ?** 0 = <3 0.5=3-5 1. >5በላይ	
119	**እራስዎን ችለዉ ይመገባሉ?** 0=ያለ እገዛ መመገብ አልችልም 1=ትንሽ ብቸገርም በራሴ እመገባለሁ 2=ያለ ችግር እመገባለሁ	
120	**የእርስዎ የአመጋገ ብሁኔታ እንዴት ያዩታል?** 0=በጣም በምግብ የተጎዱ 1=አላዉቅም / መካከለኛ በምግብ የተጎዱ2=ምንም ጉዳት የለም	
121	**እራስዎን በእድሜ እኩልከ ሆኑ ሌሎች ሰዎች ጋር ሲያነጻጽሩ የጤናዎ ሁኔታምን ይመስላል?** 0=ጥሩ አይደለም 0.5 =አላዉቅም 1=ጥሩ ነዉ 2 =በጣም ጥሩ ነዉ	
122	**የመሃል ክንድ ዙሪያ ልኬታ (MUAC) በሴ.ሜ.**0=< 21 0.5= 21-22 1 => 22	
123	**የባት ዙሪያ ልኬታ በሴ. ሜ** 0 = CC < 31 1 = CC ≥ 31	
አጠቃላይ MNA ዉጤት		
“Serum albumin”		

Oddeefannoo qorannoo waligaalan, Eeyyama hirmanna gaafachu fi gaaffilee qorannoo

Oddeefannoo Waligaala qorannoon walqabatee

Harka fuune maqaan koo_____jedhama. Oddeefannoowwan qorannoo fuunanan jira. Manguddoota wagga 60 fi sana ol ta'an haala sooranna fi isaan walqabatee gaaffilee gaafachuuf oddeefannoo as irraa argamuu tarakfilee daran barbaachisoo fuudhachuuf hedduu murtessadha. Kana fixaan basuuf gaheen isin qabdan baayyee barbaachisa dha. Gamanuuman isiniis gama keessaniin deebii murtessoof sirrii waan nuuf kennitaniif hedduu galatooma. Qabxilee armaan gadii kana erga hubattanii kallattiin gaama gaafiilee seenna

Kayyoo qorannoo: Kayyoo qorannoo kana inni guddaa meesha haala soorana manguddoolee akka magaala Maqii jiran sirriiti hojjeetuu isaa adda basuuf

Fayyidaa argamuu: hirmattoonif kallatin faayyidan argatan hin jiru. Ta'uus asii irraa oddefannoon argamuu qaamoolee ittin bulmaata sirna nyaataf soorana walqabatee basaniif Oggeeyyii fayyaaf akka galtee tokkoti gargaara.

Miidha geessisuu: hirmattootni qorannoo kana waan hirmaataniif miidhan isaanirraa gahuu salphaadha innis dhiiguu fi dhitoo iddoo lilmoon waraante.

Turtii Qorannoo: qorannoo ji'a tokkoof

Turtii waliini: gaaffilee daqiiqa 15 hanga 25 fuudhachuu danda'uu.

Iccitii Eegu: Qorannoo kana keessati gaaffilee hedduu deebisuu dandeessu. Haa ta'uu malee deebiin keessan kamiyyuu Iccitiin akkuma eegamati tura. Kunis maqaaf oddeefannoo kennitaniin ala wanti Eenyu keessaniin walqabatuu kamituu Qorannoo waliin wal hin qabatuu. Kanaaf oddeffannoon kennitan kamiyyuu Iccitiin ni eega, isin qorannoo kana keessati hirmachuun eyyamamoodha? 1. Eeyyen 2. Lakki

Consent form (Afan Oromo version)

Gucaa Eeyyama gaafachuu

Afaanani hubachuu danda'uu nyaadni Qorannoo naaf dubbifameera, bu'uuruma kanaananis kayyoo Qorannoo hubadheera.Kanaaf gaaffii kana hirmachuuf Eeyyamama ta'uu koo mallattoon mirkanneessa. Mallattoo: _____

Maqaa qorata: Magarsoo Urgeessa Oddefannoof: megurgessa@gmail.com +2519-17-56-20-88 Mallattoo: __

Maqaa Gaafata: _____Mallattoo: _____

Maqaa To'ataa: _____Mallattoo: _____

Guyyaa_____ Ji'a_____ Bara_____ Sa'a itti jalqabee: _____Sa'aitti dhumatee: ____

Questionnaire (Afan Oromo version)

Gaaffileewwan Qorannoo

Kutaa I: gaaffileeWaligaala		
100	**Saala** 1.Dhiraa 2. Dhala	
101	**Umriin keessan meeqa?** _____	
Kutaa II- Safartuwwaan qaama (yeeroo lama safaramaa)		
102	**Ulfaatina**1ffaa_____Kg2ffaa_____Kg G/galeessan _____Kg	
103	**Dheerina**1ffaa _____Sm 2ffaa___Sm G/galeessan _____Sm	
104	**MarsaawalakkaaIrree**1ffaa_____Sm2ffaa_____Sm G/galeessan _____Sm	
105	**MarsaaSarbaa**1ffaa_____Sm 2ffaa_____Sm G/galeessan _____Sm	
Kutaa III:-Gaaffilee haala sooranna manguddoota ittin calalaan		
Lakk	**Gaaffilee**	**Qabxii**
106	**Ji'oota 3 darban keessati feedhiin nyaata hir'atee yookiin sababa biroon hanga dur nyaattan hi'istanii?** 0 =Baayyee olanaan 1 = Gidduu galessaan hir'atee 2=Feedhiin hin hir'annee	
107	**Ji'oota 3 darban keessati ulfaatini keessan osoo itti hin yaadin hir'ateera?** 0= Kiloo 3 ol1 =Hin beeku 2= Hir'ina kiloo 1-3 ni ta'a 3 =Hin hir'annee	
108	**Haalli sochii keessan maal fakkaata?** 0= Siree irraatti hafeera 1=Siree irraa nan ka'a garuu ala bahuu hin danda'uu 2 = Nan bahaa	
109	**Ji'oota 3 darban keessati rakkoon xinsammuuf dhiphinaa yookiin dhibeen isin muudatee beeka?** 0= Eeyyen2= Lakki hin beeku	
110	**Yeeroo dheeraf yookin gaddi cimaan isin muudate jiraa?** 0 =Muukuyookingaddaaolaana1 = Muukugidduugaleessa 2 = Hinqabu	
111	**Ulfaatina hiruu eskuumetiri dheerina (BMI)** 0 =< 19 1 =19 - 21 2= 21-23 3 =≥ 23	
112	**Gargaarsa nama kamiyyuu ala jirachaa jirtuu?** 0= Lakki 1 =Eeyyen	
113	**Guyyaati qoorichoni 3 ol isiniif ajajamaaniruu?** 0= Lakki 1=Eeyyen	
114	**Gogaa qama keessan irraatti bakki mada'ee jiraa?** 0 = Lakki 1=Eeyyen	
115	**Guyyaaticiree, laqaana fi irbaata ni nyaatuu yookiin simeeqa nyaattu**? 0= Si'a 1 guyyaati1 =Si'a 2 guyyaati 2 = Si'a 3 guyyaati	
116	**Soorata qaama ijaaran keessa** **(0=Yoo 0 yookiin 1 Eeyyenta'e ,0.5=yoo 2 Eeyyen ta'e, 1=Yoo 3 Eeyyen ta'e)** Guyyaati bu'awwaan ananii si'a 1 ni soorattuu? 1. Eeyyen 2.Lakki Guyyaati si'a 2 fi isaa ol hanqaquu yookiin dheedhiwwan garagaraa ni soorattuu? 1. Ee 2. Lak Foon, qurxummii guyyaa guyyaanni soorattuu? 1.Eeyyen 2. Lakki	
117	**Guyyaati si'a 2f isaa ol kuuduraf muudura ni soorattuu?** 0=Lakki1 = Eeyyen	
118	**Guyyaati dhangaala (bishaan, anaan, cuunfa) hangam dhugduu?** 0.0 = Burcuuqoo3 gadi0.5 = Burcuuqoo 3 hanga 5 1.0 = Burcuuqoo 5 ol	
119	**Nyaata ofii keessaniin dandeessani nyaattu?** 0=Gargaarsa malee hin danda'uu 1=Xiqqoo na rakkisuu illee ofiif nyaadha 2 =Rakkoo malee nyaadha	

120	**Sadarkaa soorannaa keessan yoo ilaaltan maal fakkattuu?** 0=Baayyee nyaatan miidhame1=Hin beeku yookiin xiqqoo miidhame 2=Rakkoo hin qabuu	
121	**Namoota biro umuriin wal fakkataniin yoo of madaaltan haalli fayyumaa keessan maalfakkaata?** 0.0 = Gaarii miti 0.5 = Hin beeku 1.0 = Gaariidha 2.0 = Baayyee gaariidha	
122	**Marsaa walakkaa Irree seentimeetira**(MUC) 0.0 = < 21 0.5= 21- 22 1.0 = > 22	
123	**Marsaa sarbaa seentimeetira(CC)** 0 = < 31 1 = ≥ 31	
Waligaala MNA firii Ida'amaa		
"Serum albumin"		

Declaration

- I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

  Name of investigator: **Megersso Urgessa** Signature: _____

  Name of the institution: **Jimma University** Date of submission: _____

- This thesis has been submitted for examination with my approval as University advisor

  Name and Signature of the first advisor

  Mr. Alemayehu Argaw (MSc in Human Nutrition) _____

  Name and Signature of the second advisor

  Mr. Getu Gizaw (MSc in Human Nutrition) _____