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Assessment of Nutrition Status of Adults Using the Nutrition Focused Physical Examination

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23 **RESEARCH SNAPSHOT**

24 **Research Question:** Can the Nutrition Focused Physical Exam (NFPE) be used to successfully

25 identify malnutrition in older adults?

26 **Key Findings:** The NFPE successfully identified malnutrition in older adults in agreement with

27 analysis of a 24-hour dietary recall revealing nutrient deficiencies.

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29 **Assessment of Nutrition Status of Adults Using the Nutrition Focused Physical**

30 **Examination**

31 **ABSTRACT**

32 **Background:** Thirteen percent of the United States (U.S.) population is over 65 years of age and

33 up to 50% are malnourished; therefore, seniors were chosen as the subjects for this research

34 study.

35 **Objective:** To identify malnutrition in older adults using the Nutrition Focused Physical

36 Examination (NFPE), and to compare the results to the Academy of Nutrition and Dietetics

37 parameters for assessment of nutritional status.

38 **Design:** Each senior voluntarily completed a head-to-toe NFPE, 24-hour diet recall, and

39 anthropomorphic measures were also taken. Information was later analyzed and results were

40 given to each participant.

41 **Participants/setting:** Seniors from the Senior Center in Arkadelphia, Arkansas volunteered for

42 the study in the summer of 2018.

43 **Main outcome measures:** The NFPE was used to identify areas of malnutrition and 24-hour diet

44 recall information was assessed in comparison to the DRI.

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45 **Statistical analyses performed:** Results were calculated using Nutritionist Pro®, Excel® and

46 SPSS®.

47 **Results:** Sixty-four percent had subcutaneous fat loss in the orbital region, 40% in the upper arm

48 region, and 27% and 10% in the thoracic and lumbar region respectively. Sixty-seven percent

49 had muscle loss in the temple region, 37% in the clavicle bone region, 17% in the scapular bone

50 region, and 70% in the dorsal hand. Of the 30 subjects participating in the study, 93% had some

51 form of malnutrition. Nutrient analysis showed significant correlation between age and protein,

52 carbohydrate, saturated fat, monounsaturated fat, polyunsaturated fat, sodium, iron and kcalories

53 consumed. Intake of potassium, and calcium were significantly below the DRI for both genders.

54 Sodium intake was significantly above the DRI for both genders.

55 **Conclusion:** The NFPE was successful in identifying malnutrition in a sample of elderly

56 subjects as confirmed by the low nutrient intake levels reported. However, further research is

57 needed to quantitatively assess the validity and reliability of the NFPE.

INTRODUCTION

Malnutrition in elderly

Malnutrition is a general term used to describe a nutritional imbalance.[1-4] Both over and under nutrition are categorized as malnutrition.[2-3] According to the Academy of Nutrition and Dietetics (AND) malnutrition diagnosis is warranted by detection of two or more of the following characteristics: "insufficient energy; weight loss; loss of subcutaneous fat; loss of muscle mass; localized or generalized fluid accumulation that may sometimes mask weight loss; and diminished functional status."[3,5-7]

As of 2016, 15.2% of the US population was 65 years of age or older and this number is predicted to surpass 23.5% by 2035. This demographic shift will leave a larger geriatric than youth population.[8] In 2010, 16% of people over 65 years of age and 2% over 85 years of age were classified as malnourished and those numbers have since increased.[1] Geriatrics are especially susceptible to malnutrition as they often have risk factors like poor nutrient absorption, decreased caloric intake and excessive nutrient loss. Some personal factors are; age, apathy or depression, disease, limited mobility, sensory loss, clinical treatments or drug therapy, and the inability of those persons to buy, cook, or consume (chew or swallow) food.[2,9-10]

Consequences for the patient with malnutrition include weakened immune system response, increased risk of pressure ulcers, delayed wound healing, decreased intestinal absorption of nutrients, compromised renal function, muscle wasting, functional loss increasing the risk of falls, increased hospital stay, higher treatment cost, readmission and increase in mortality.[1-4] Malnutrition can also cause extra stress on acute healthcare facilities. Failure to diagnose malnutrition can negatively impact the amount of financial aid a healthcare facility receives from insurance and these losses can be significant. Additionally, patients with untreated

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81 malnutrition heal at slower rates and are more likely to be readmitted within 30 days of their

82 discharge.[3]

83 Research has found that malnutrition affects 62% of patients in hospitals, and 85% of

84 nursing home residents however only 7.0% of cases are diagnosed by health professionals.[1-3,5-

85 6,11-12] Malnutrition remains poorly diagnosed for a variety of reasons. Lack of nutritional

86 assessment and nutritional training, confusion regarding nutritional responsibility, failure to

87 record anthropomorphic measures, or patient intake, and lack of staff involvement with feeding

88 are all possible reasons that malnutrition could go undiagnosed. Over half of the individuals with

89 malnutrition remain unaware of their condition.[2-4]

90 **Nutrition Focused Physical Exam**

91 Nutrition screenings help determine malnutrition. Since malnutrition is reversible, early detection

92 leads to faster treatment and prevention plans for those at risk. The line between screening and

93 assessment can often be blurred, but the two serve distinct functions. The purpose of screening is

94 to identify individuals who may be at risk for malnutrition.[13] Nutrition screenings should be

95 performed at regular intervals, especially for older adults in an acute care setting, as nutrition

96 status is dynamic and can quickly change.[14] Once an individual has been identified as "at risk" a

97 follow-up assessment should be performed. According to AND, assessment entails a diet history,

98 physical measurements, clinical data, nutrition focused physical findings and background

99 information on the patient.[13,15]

100 The NFPE is a head-to-toe examination designed to evaluate physical appearance as well as

101 functional status in order to identify signs of malnutrition.[7,16] Of the characteristics used to

102 diagnose malnutrition, four of the six are best recognized by physical examination.[5-7]

103   The NFPE is capable of recognizing vitamin, mineral, and protein-energy deficiencies

104   that may go unrecognized by other assessment methods.[6,17] Orbital, upper arm, thoracic and

105   lumbar, temple, clavicle bone, acromion bone, scapular bone, dorsal hand, patellar, anterior

106   thigh, and posterior calf region, are all thoroughly assessed for signs of muscle of fat loss.

107   Additionally, hair, skin, nails and the oral cavity are inspected for manifestations of

108   micronutrient deficiency and levels of edema are judged.[18-21] Each area of the body is categorized

109   as well nourished, mild to moderately malnourished, or severely malnourished.[19] (Refer to Table

110   1)

111   The objective of the research is to identify malnutrition in older adults using the NFPE,

112   and to compare the results to the Academy of Nutrition and Dietetics parameters for assessment

113   of nutritional status. Researchers observations after performing the NFPE were verified by

114   comparing the data to an analysis of each subjects' 24-hour diet recall.

115   **MATERIALS AND METHODS**

116   **Training**

117   Two undergraduate students from Ouachita Baptist University's (OBU) Nutrition and Dietetics

118   department were granted approval from the Institutional Review Board at OBU. The researchers

119   began by receiving peer-champion training in administering the NFPE from their mentor who

120   had previously completed the NFPE hands-on training workshop sponsored by AND. Several

121   articles were reviewed by the undergraduates including Academy of Nutrition and Dietetics:

122   Scope of Practice for the Registered Dietitian,[22] Academy of Nutrition and Dietetics: Revised

123   2012 Standards of Practice in Nutrition Care and Standards of Professional Performance for

124   Registered Dietitians,[23] Consensus Statement of the Academy of Nutrition and

125   Dietetics/American Society for Parenteral and Enteral Nutrition: Characteristics Recommended

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126   for the Identification and Documentation of Adult Malnutrition (Undernutrition),[12]

127   Differentiating Malnutrition Screening and Assessment: A Nutrition Care Process Perspective,[13]

128   and Nutrition-focused Physical Examination: Skin, Nails, Hair, Eyes, and Oral Cavity.[21] The

129   Academy's Nutrition Focused Physical Exam Pocket Guide[5] as well as Litchford's Nutrition

130   Focused Physical Assessment: Making Clinical Connections[20] book were studied to familiarize

131   the students with signs of malnutrition. Videos from the University of North Florida's dietetic

132   interns[24] and the University of California San Diego Health[8] were also used.

133   Researchers purchased a penlight in order to assess the eyes and mouth. The

134   undergraduates applied their knowledge by performing the NFPE on one another while being

135   critiqued by their trained mentor. Before visiting the site, the researchers created a chart designed

136   to represent the body areas to be examined. The chart designated space to record each body

137   region as well nourished, mild to moderate, or severely malnourished. The body areas listed on

138   the chart were hair, orbital region, mouth, clavicle, shoulders, triceps, scapular, ribs, iliac, hand,

139   quads, calves, edema and skin.

140   **Participants**

141   Participants in this study were attendees of the Arkadelphia, Arkansas Senior Center. Over the

142   course of two mornings, the senior adults at the center were asked if they would consider taking

143   part in the voluntary study. In total, 31 senior adults participated. The ages of participants ranged

144   from 63 to 90 years old.

Procedures

Interaction with the subjects began by the individual signing an informed consent form that stated the nature of the study. After, the data collection began. Data was obtained through three different assessment methods. First, anthropomorphic measures were obtained with an electronic scale and a manual stadiometer. Subject age was asked and gender and race were non-verbally documented. Then a thorough NFPE was performed by carefully evaluating each body area according to the prepared chart. The assessment began at the head with hair and face and continued down the body ending with the feet. While one researcher performed the assessment, the other documented the findings as either well nourished, mild to moderate, or severely malnourished by adding a tally to the corresponding box in the chart. Finally, a 24-hour diet recall was performed individually with each subject. A researcher recorded all food items consumed the previous day as well. Preparation method, time of day consumed, and amount of each item consumed were also noted. Upon exit the participant received a brief handout with nutrition and physical activity tips from the USDA's dietary guidelines.

Analysis of Data

All data collected was considered confidential. Because of this, researchers deleted subject names and instead assigned numbers to each set of data to differentiate subjects. The researchers began analyzing the data by using height and weight to calculate BMIs and BMI weight status categories for each subject. Once BMIs were calculated, anthropomorphic measurements, age, race and gender were entered into an Excel spreadsheet.

The analysis then proceeded to the diet histories. Researchers entered each subject's 24-hour recall into Nutritionist Pro®. Each item was entered according to the specific data recorded. Nutritionist Pro calculated a complete list of micro and macronutrients for each

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168 individual. Total kcalories, carbohydrates, protein, fat, cholesterol, saturated fat,

169 monounsaturated fat, polyunsaturated fat, trans fat, sodium, potassium, calcium and iron values

170 were highlighted. This data was entered into the the existing Excel Ⓡ sheet. The researchers then

171 obtained the official Daily Reference Intake (DRI) values for each of these nutrients. The

172 subject's individual micro and macronutrient values were tagged green if they exceeded the

173 recommended value and red if they fell below.

174 The researchers then entered the data into the Statistical Package for the Social Sciences

175 (SPSS) and conducted a bivariate (Pearson) correlation comparing age with nutrients and

176 calories. Descriptive statistics for kcalories, carbohydrates, protein, fat, cholesterol, saturated fat,

177 monounsaturated fat, polyunsaturated fat, trans fat, sodium, potassium, calcium, iron, age and

178 BMI were also completed with SPSS. A one-sample *t* test comparing nutrient intake with DRI

179 was conducted.

180 **RESULTS**

181 **Nutrition Focused Physical Exam**

182 Thirty-one senior adults volunteered for this study. One data set was removed as an outlier.

183 Therefore, the data of 30 subjects was examined. Subject ages ranged from 63 to 90 years old.

184 Seventeen percent (n=5) of the participants were between the ages of 60 and 69, 37% (n=11)

185 were between the ages of 70 and 79 and 47% (n=14) were over 80 years of age. Two races were

186 represented in this sample. Sixty-seven percent (n=20) of subjects were Caucasian and 33%

187 (n=10) were African American. The BMI calculations revealed that no subjects were classified

188 as underweight. According to CDC classifications 33.3% (n=9) of subjects were at a normal

189 weight, 41% (n=11) were overweight and 26% (n=7) were obese.

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190   The physical assessments found that 83% (n=25) subjects showed signs of being well

191   nourished and 17.0% (n=5) were mild to moderately malnourished in the mouth region. Thirty-

192   three percent (n=10) of subjects were well nourished in the temple region, 54% (n=16) were mild

193   to moderately malnourished and 13% (n=4) showed signs of severe malnutrition. Thirty-six

194   percent (n=11) of subjects had well nourished eyes, 57% (n=17) had mild to moderately

195   malnourished eyes and 7.0% (n=2) showed signs of severe malnutrition. In hair, iliac and quad

196   muscle 93% (n=28) of subjects were recorded as well nourished and 7.0% (n=2) were mild to

197   moderately malnourished in each category. Edema and skin both showed 87% (n=26) as well

198   nourished and 13% (n=4) as mild to moderately malnourished. Clavicle assessments found 63%

199   (n=19) as well nourished, 27% (n=8) as mild to moderately malnourished and 10% (n=3) as

200   severely malnourished. Eighty-three percent (n=25) of subjects' shoulders were recorded as well

201   nourished, 10% (n=3) were found as mild to moderately malnourished and 7.0% (n=2) showed

202   signs of severe malnutrition. Sixty percent (n=18) of subjects were well nourished in the triceps,

203   33% (n=10) were mild to moderately malnourished, and 7.0% (n=2) were severely

204   malnourished. Hand inspection showed 30% (n=9) of subjects as well nourished, and 70%

205   (n=21) as mild to moderately malnourished. Seventy-three percent (n=22) of subjects were

206   recorded as well nourished in the rib region, and 27% (n=8) were recorded as mild to moderately

207   malnourished. In the calf, 97% (n=29) of subjects were well nourished and 3% (n=1) showed

208   mild to moderate malnutrition.

209   **Diet Recall**

210   Analysis of the 24-hour diet recalls found that 53% (n=16) of the subjects interviewed were not

211   meeting the recommended daily energy intake. Three males exceeded the 2,000kcal DRI. Four

212   females exceeded the 1,600kcal DRI. Nutrient analysis showed a significant correlation between

213 age and protein intake (r=.53, p≤.002), carbohydrate intake (r = .44, p≤.014), fat intake (r=.52,

214 p≤ .003), kcalories consumed (r=.59, p≤.001), saturated fat intake (r=.39, p≤ .033),

215 monounsaturated fat intake (r=.39, p≤ .029), polyunsaturated fat intake (r=.39, p≤ .032), sodium

216 intake (r=.51, p≤ .004), iron intake (r=.74, p≤ .000), and body mass index (r=.59, p≤ .001).

217   Forty percent (n=12) of subjects did not meet the recommended daily intake for protein.

218 Eight males met the 60 gram (g) DRI for protein. Ten females met the 46g DRI for protein.

219 Carbohydrate intake was lacking in 33% (n=10) of subjects. Eleven females and eight males

220 exceeded the 130g DRI for carbohydrates.

221   Female intake of potassium (p≤ .000), calcium (p≤.000), and kcalories (p≤ .000) was

222 significantly below the DRI level, but sodium intake (p≤.009) was significantly above the DRI.

223 Levels of potassium and calcium were under the recommended levels in 100% (n=30) and 93%

224 (n=28) of subjects respectively. Male intake of potassium (p≤ .000), calcium (p≤ .000), iron (p≤

225 .020), and carbohydrates (p≤ .014) were significantly below the DRI, but sodium intake (p≤

226 .008) was significantly above the DRI. All subjects fell below the recommended intake for

227 potassium. Only one female and one male met the DRI for calcium. Iron intake was below the

228 recommended level in 47% (n=14) of subjects.

229   The mean intakes of saturated, monounsaturated (MUFA) and polyunsaturated fat

230 (PUFA) for females were 137g, 12.6g and 8.2g respectively. The mean intakes of saturated,

231 MUFA, and PUFA for males were 21.8g, 16.2g and 17.5g respectively. The mean intake of trans

232 fat was 0.2g for females and 0.1g for males. Nine males and sixteen females exceeded the DRI

233 for total fat. Six females and two males were over the 300mg per day recommendation for

234 cholesterol. (Refer to Table 2)

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235 **DISCUSSION**

236 **Summary of findings**

237 According to results from the NFPE, 93% of the subjects had some form of malnutrition

238 manifested in one of their assessed body regions. These findings were confirmed by analysis of

239 the 24-hour recall information which revealed several key nutrient deficiencies. Female intake of

240 potassium, calcium, and kcalories was significantly below the DRI level. Male intake of

241 potassium, calcium, iron, and carbohydrates was significantly below the DRI. Sodium intake was

242 significantly above the DRI for both genders. The NFPE and dietary recall were in agreement

243 concerning the malnutrition status of many of the subjects.

244 Researchers concluded that based on these results the NFPE is an acceptable tool to

245 assess malnutrition in the elderly based on the standards specified by AND. When it comes to

246 nutrition screening and assessment, there are many variations and no one tool is used

247 universally.[14] The most widely used screening and assessment tools for adult malnutrition are the

248 Malnutrition Screening Tool, the Malnutrition Universal Screening Tool, the Nutritional Risk

249 Screening, the Short Nutrition Assessment Questionnaire, the Geriatric Nutrition Risk Index, the

250 Minimum Data Set, Seniors in the Community: Risk Evaluation for Eating and Nutrition, the

251 Mini Nutrition Assessment and its Short Form variation, and the Subjective Global Assessment.

252 These screening and assessment tools have all been verified for their validity as well as their

253 reliability through multiple studies.[2,25-32] Further research is needed to quantitatively assess the

254 validity and reliability of the NFPE in diagnosing malnutrition.

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Strengths and limitations

One strength of this study is its combined use of both physical assessment and diet recall information. Having both sets of data allowed researchers to make confident conclusions based on their findings since patient information is verified by more than one source.

This study was limited as it failed to assess extra variables including recent weight change, illness, and appetite. Future studies should expand on this pilot by including questions pertaining to these issues in order to strengthen conclusions.

CONCLUSION

Considering the elevated risk of malnutrition in the geriatric population, it is crucial that health professionals employ thorough and accurate malnutrition screenings and assessments. Screening and assessment for malnutrition in the elderly must be designed with the knowledge that nutrition status and disease state are closely intertwined, and the natural effects of aging must also be accounted for. While a more recent assessment method, the NFPE is highly relevant in diagnosing malnutrition. Use of the NFPE highlights the importance of dieticians in the multidisciplinary team. For further studies and clinical applications, the NFPE should be used in conjunction with other assessment methods in order to identify the cause of malnutrition so that a specific treatment plan can be developed. This information provided by the NFPE is essential in developing a holistic treatment plan for and ensuring the highest quality care for each patient.

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349   Table 1. Physical Exam: Parameters Useful in the Assessment of Nutritional Status

Exam Areas	Severe Malnutrition	Mild-Moderate	Well-Nourished
Subcutaneous Fat Loss			
Orbital region- Surrounding the eye	Hollow look, depressions, dark circles, loose skin	Slightly dark circles, somewhat hollow look	Slightly bulged fat pads. Fluid retention may mask loss
Upper arm region - Triceps/biceps	Very little space between folds, fingers touch	Some depth pinch, but not ample	Ample fat tissue obvious between folds of skin
Thoracic and lumbar region- Ribs, lower back, midaxillary line	Depression between the ribs very apparent. iliac crest very prominent.	Ribs apparent, depressions between them less pronounced. Iliac crest somewhat prominent.	Chest is full, ribs do not show. Slight to no protrusion of the iliac crest
Muscle Loss			
Temple Region - Temporalis muscle	Hollow, scooping depression	Slight depression	Can see/feel well-defined muscle
Clavicle bone region - Pectoralis major, deltoid, trapezius muscles	Protruding, prominent bone	Visible in male, some protrusion in female	Not visible in male, visible but not prominent in female
Clavicle and acromion bone region - deltoid muscle	Shoulder to arm joint looks square. Bones prominent. Acromion protrusion very prominent.	Acromion process may slightly protrude	Rounded, curves at arm/shoulder/neck
Scapular bone region - Trapezius, supraspinus, infraspinus muscles	Prominent, visible bones, depression between ribs/scapula or shoulder/spine	Mild depression or bone may show slightly	Bones not prominent, no significant depressions
Dorsal hand - Interosseous muscle	Depressed area between thumb-forefinger	Slightly depressed	Muscle bulge
Lower body			
Patellar region - Quadriceps muscle	Bones prominent, little sign of muscle around the knee	Knee cap less prominent, more rounded	Muscles protrude, bones not prominent
Anterior thigh region - Quadriceps muscles	Depression/line on thigh, obviously thin	Mild depression on inner thigh	Well-rounded, well-developed
Posterior calf region - Gastrocnemius Muscle	Thin, minimal to no muscle definition	Not well-developed	Well-developed bulb of muscle
Edema			
Rule out other causes of edema, patient at dry weight	Deep to very deep pitting lasts a short to moderate time (31-60sec), extremity looks swollen	Mild to moderate pitting, slight swelling of the extremity, indentation subsides quickly	No sign of fluid accumulation

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351   Table 2. Results of One-Sample t-test Comparing Nutrient Intake with Dietary Reference Intake

352   (DRI)

Nutrient	DRI Value	Mean (±SD)	t	df	Significance (2-tailed)	Mean Difference	95% CI
Potassium (Females)	4700mg	1604.55 ±736.17	-18.33	18	0.00	-3095.45	-3450.27, -2740.63
Potassium (Males)	4700mg	2059.06 ± 740.51	-11.83	10	0.00	-2640.94	-3138.42, -2143.46
Calcium (Females)	1200mg	534.52 ±319.70	-9.074	18	0.00	-665.48	-819.57, -511.40
Calcium (Males)	1200mg	593.09 ±377.04	-5.34	10	0.00	-606.90	-860.21, -353.61
Kcalories (Females)	1600	1173.78 ±348.32	-5.33	18	0.00	-426.22	-594.10, -258.34
Kcalories (Males)	2000	1683.67 ±703.62	-1.49	10	0.17	-316.33	-789.03 , -156.37
Iron (Females)	8mg	8.77 ±4.10	0.818	18	0.42	0.77	-1.21, 2.74
Iron (Males)	8mg	11.57 ± 4.28	2.77	10	0.02	3.57	0.70, 6.45
CHO (Females)	130g	148.64 ±49.20	1.65	18	0.12	18.64	-5.07, 42.35
CHO (Males)	130g	203.93 ±83.05	2.95	10	0.01	73.93	18.14, 129.72
Sodium (Females)	1200mg	2026.51 ±1237.70	2.91	18	0.01	826.51	229.96, 1423.06
Sodium (Males)	1200mg	2534.4 ± 1339.9	3.30	10	0.01	1334.36	434.19, 2234.53
Protein (Females)	46g	49.84 ±21.98	0.761	18	0.46	3.84	-6.76, 14.43
Protein (Males)	56g	66.21 ±27.54	1.23	10	0.25	10.21	-8.29, 28.71

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