



Nutritional Status of Rural Older Adults Is Linked to Physical and Emotional Health



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ARTICLE INFORMATION

Article history:

Submitted 25 August 2016
Accepted 17 January 2017
Available online 6 March 2017

Keywords:

Rural older adults
Depressive affect
Loneliness
Perceived health status
Nutritional status

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<http://dx.doi.org/10.1016/j.jand.2017.01.013>

ABSTRACT

Background Although nutritional status is influenced by multidimensional aspects encompassing physical and emotional well-being, there is limited research on this complex relationship.

Objective The purpose of this study was to examine the interplay between indicators of physical health (perceived health status and self-care capacity) and emotional well-being (depressive affect and loneliness) on rural older adults' nutritional status.

Design The cross-sectional study was conducted from June 1, 2007, to June 1, 2008.

Participants/setting A total of 171 community-dwelling older adults, aged 65 years and older, residing within nonmetro rural communities in the United States participated in this study.

Main outcome measures Participants completed validated instruments measuring self-care capacity, perceived health status, loneliness, depressive affect, and nutritional status.

Statistical analyses performed Structural equation modeling was employed to investigate the complex interplay of physical and emotional health status with nutritional status among rural older adults. The χ^2 test, comparative fit index, root mean square error of approximation, and standardized root mean square residual were used to assess model fit.

Results The χ^2 test and the other model fit indexes showed the hypothesized structural equation model provided a good fit to the data ($\chi^2(2)=2.15$; $P=0.34$; comparative fit index=1.00; root mean square error of approximation=0.02; and standardized root mean square residual=0.03). Self-care capacity was significantly related with depressive affect ($\gamma=-0.11$; $P=0.03$), whereas self-care capacity was not significantly related with loneliness. Perceived health status had a significant negative relationship with both loneliness ($\gamma=-0.16$; $P=0.03$) and depressive affect ($\gamma=-0.22$; $P=0.03$). Although loneliness showed no significant direct relationship with nutritional status, it showed a significant direct relationship with depressive affect ($\beta=.4$; $P<0.01$). Finally, the results demonstrated that depressive affect had a significant negative relationship with nutritional status ($\beta=-.30$; $P<0.01$). The results indicated physical health and emotional indicators have significant multidimensional associations with nutritional status among rural older adults.

Conclusions The present study provides insights into the importance of addressing both physical and emotional well-being together to reduce potential effects of poor emotional well-being on nutritional status, particularly among rural older adults with impaired physical health and self-care capacity.

J Acad Nutr Diet. 2017;117:851-858.

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M AINTAINING GOOD NUTRITIONAL STATUS IS essential for healthy aging in rural America. Health promotion programming is one intervention practitioners can use to identify and monitor the health needs of rural older adults.¹ Previous research suggests that poor nutritional status among older adults is associated with decreased immune function, greater health care expenditure, and longer hospital stays.² Thus, it is vital to understand risk factors that may place older adults at greater risk of poor nutritional status.

The association between emotional well-being and nutritional status has been well documented.^{3,4} Particularly, depression and feelings of loneliness have been identified as key risk factors for malnutrition among older adults.^{3,5,6} Older adults with depressive symptoms tend to lose their appetite, refuse to eat, and experience weight loss.^{7,8} Depressive symptoms are also associated with unhealthy food choices such as increased intake of foods high in added sugars and lower intake of fruits or vegetables.^{9,10} In addition, loneliness can affect older adults' appetites, resulting in consumption of fewer regular meals, more frequent use of convenience foods, and decreased amount and variety of foods eaten.^{3,11,12}

Poor emotional well-being among older adults is hypothesized to be a behavioral response to aging-related impairments that compromise physical health and impair self-care capacity.^{13,14} Cohen-Mansfield and Parpura-Gill proposed a theoretical framework called Model of Depression and Loneliness (MODEL) based on the Cognitive-Behavioral Theory to explain the interaction between physical health status and emotional well-being.¹⁴ In this theory, poor self-care capacity is strongly associated with feelings of loneliness among older adults.¹⁴ Furthermore, poor self-care capacity can lead to restricted social activities, which can contribute to depressive symptoms among older adults.¹⁵ In addition, Savikko and colleagues¹⁶ reported that poor health status was a potential contributor to feelings of loneliness. Previous studies also have found a negative association between low perceived health status and depressive symptoms in community-dwelling older adults.^{13,17} Empirical evidence suggests feelings of loneliness are also a strong predictor of depressive symptoms among socially isolated older adults.^{18,19} Thus, the relationship between physical health and emotional well-being is complex and multifactorial.

Not only is poor physical health associated with diminished emotional well-being, it is also related to poor nutritional status among older adults.²⁰ Donini and colleagues¹⁷ reported that older adults with impaired self-care capacity to grocery shop and prepare meals were at a greater risk of malnutrition. Thus, a vicious cycle can be generated where progressive functional decline, poor nutritional status, and emotional decline exacerbate each other.

Unfortunately, older adults residing in rural areas generally have fewer opportunities for social interaction. This is commonly due to geographic isolation and out-migration of younger adults who serve as supportive resources.²¹ Due to this limited social engagement, older adults living in rural areas are more likely to experience feelings of loneliness and depressive symptoms.²² Studies have reported that older adults residing in rural areas have higher rates of depressive symptoms than those living in urban areas.^{23,24} In addition, rural older adults have been reported to face a greater number of chronic conditions and impaired self-care capacity than older adults residing in urban areas.²⁵

Although nutritional status is influenced by multidimensional aspects encompassing physical and emotional well-being, there is limited research on this complex relationship.²⁶ Identifying the interplay of these factors on rural older adults' nutritional status can serve as a basis for development of nutrition education programs to improve nutritional status.

Cohen-Mansfield and Parpura-Gill¹⁴ developed the theoretical model to examine predictors of loneliness among low-income older adults, including physical health and emotional well-being variables. Therefore, this study extended upon MODEL to further inform the associations among physical health (perceived health status and self-care capacity) and emotional well-being (depressive affect and loneliness), along with the addition of nutritional status, among rural older adults.

The following hypotheses (H) and expected outcomes of the investigation included (Figure 1):

- H1=lower self-care capacity will have a direct negative relationship with depressive affect.
- H2=lower self-care capacity will have a direct negative relationship with loneliness.
- H3=lower perceived health status will have a direct negative relationship with loneliness.
- H4=lower perceived health status will have a direct negative relationship with depressive affect.
- H5=higher loneliness will have a direct negative relationship with nutritional status.
- H6=higher loneliness will have a direct positive relationship with depressive affect.
- H7=higher depressive affect will have a direct negative relationship with nutritional status.

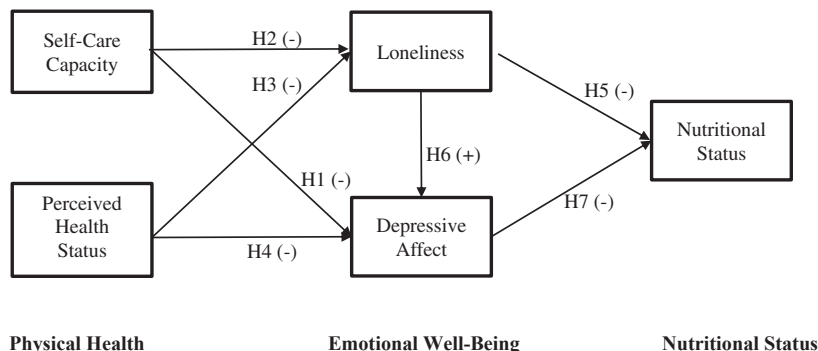


Figure 1. Proposed structural equation model for the relationship of physical health, emotional well-being, and nutritional status. Hypothesis (H) 1=lower self-care capacity will have a direct negative relationship with depressive affect. H2=lower self-care capacity will have a direct negative relationship with loneliness. H3=lower perceived health status will have a direct negative relationship with loneliness. H4=lower perceived health status will have a direct negative relationship with depressive affect. H5=higher loneliness will have a direct negative relationship with nutritional status. H6=higher loneliness will have a direct positive relationship with depressive affect. H7=higher depressive affect will have a direct negative relationship with nutritional status.

- H6=higher loneliness will have a direct positive relationship with depressive affect.
- H7=higher depressive affect will have a direct negative relationship with nutritional status.

METHODS

Study Setting and Subjects

The US Office of Management and Budget Metropolitan Statistical Areas definition and the US Census definition of rural were used to target rural community-dwelling older adults.²⁷ Community-dwelling older adults, aged 65 years and older, who resided within nonmetro rural communities located in Northwest Oklahoma with populations of 2,500 or less were solicited to participate in this cross-sectional study. All participants were solicited and recruited through the Oklahoma aging service network, including senior nutrition and activity sites, Oklahoma Aging Division, Area Agencies on Aging, and Oklahoma State University Cooperative Extension Service County Educators. Survey procedures were conducted at senior nutrition and activity sites as well as County Cooperative Extension Service office sites from June 2007 to June 2008.

To identify individuals who required assistance in reading, writing, and comprehension, cognitive status of all interested participants was screened using the Short-Portable Mini-Mental Status Questionnaire (SPMSQ), a brief 10-item instrument used to examine short- and long-term recall of information.²⁸ Based on SPMSQ recommendations, participants scoring ≥ 4 were excluded from the study due to a score indicative of mild to moderate dementia.²⁸ After excluding two individuals based on the SPMSQ cutoff score, a total of 171 participants were included in the analyses. Participation in this study involved completion of a self-report survey.

The study protocol was approved by the Oklahoma State University Institutional Review Board for Human Subjects. All participants were asked to read and sign an informed consent form. For those who needed assistance, a trained member of the research team conducted a private one-to-one reading and explanation of the informed consent.

Measures

Sociodemographic Information. Sociodemographic information was collected from participants, including age, sex, race or ethnicity, marital status, education, and annual income.

Perceived Health Status. The 4-item Subjective Health Perceptions Scale from the Duke Older Americans Resources and Services Procedures (OARS) was used to assess perceived health status.²⁹ Item scores were summed to create a perceived health status score. Perceived Health Status scores range from 4 to 14. A higher score represents higher perceived health, whereas a lower score indicates lower perceived health. Cronbach's α reliability for this measure in the current study was satisfactory at $\alpha=.76$.

Self-Care Capacity. The 13-item Self-Care Capacity Scale from the OARS was used to assess ability to perform activities of daily living (eg, bathing, dressing, eating, getting in or out of bed or a chair, walking, and toileting) and instrumental activities of daily living (shopping, cooking, and cleaning). Item scores are summed to derive a self-care capacity score.

Self-care capacity scores range from 13 to 39. A higher score reflects higher self-care capacity, whereas a lower score indicates lower self-care capacity. The OARS Self-Care Capacity Scale items have evinced high reliability ($r=.84$).²⁹ Cronbach's α reliability in the present study emerged as moderate at $\alpha=.57$.

Loneliness. The 10-item University of California, Los Angeles, Loneliness Scale-Version was used to assess feeling of loneliness.³⁰ Item scores are used to create a loneliness score. Loneliness scores range from 10 to 29. A lower score reflects low feelings of loneliness, whereas a higher score indicates higher feelings of loneliness. Cronbach's α reliability for the loneliness scale in the present study was $\alpha=.75$.

Depressive Affect. The 10-item Geriatric Depression Scale was used to measure depressive affect.³¹ Item scores were summed to derive a Geriatric Depression Scale score. Geriatric Depression Scale scores range from 0 to 10 with a higher score indicating a higher depressive affect and a lower score indicating lower depressive affect. Cronbach's α reliability for the geriatric depression scale in the present study was $\alpha=.77$.

Nutritional Status. Nutritional status was measured using the Mini-Nutritional Assessment Short-Form,³² which is a validated assessment tool used to identify risk of malnutrition among older adults in clinics, hospitals, and nursing homes. The Mini-Nutritional Assessment Short-Form includes measurements on height, weight, appetite, weight loss, mobility, acute psychological stress, and neuropsychological problems.³² Body mass index, appetite, weight loss, mobility, psychological stress, and neuropsychological problems scores were summed to derive a nutritional status score. Nutritional status scores range from 0 to 14. A higher score indicates higher nutritional status, whereas a lower score indicates lower nutritional status.

Statistical Analysis

Descriptive statistics and correlation analysis were conducted before the primary data analysis. Response rate for each measure was also assessed. Structural equation modeling using Mplus 7.1³³ was employed to investigate the complex interplay of physical and emotional indicators with nutritional status among rural older adults. Figure 1 presents the theoretical structural equation model used to examine the research questions. To assess whether the theoretical model fit the data, various fit indexes associated with structural equation modeling techniques were examined: χ^2 goodness-of-fit test, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). General fit indexes cutoff values indicating acceptable fit are CFI ≥ 0.90 , RMSEA < 0.08 , and SRMR ≤ 0.08 .³⁴⁻³⁶ Descriptive statistics and correlation analyses were conducted using IBM SPSS Statistics for windows version 22.0.³⁷ Given that all hypotheses were directional, one-tailed P values ($P < 0.05$ and $P < 0.01$) were reported for the parameter estimates in the structural equation model.

RESULTS

Table 1 includes descriptive statistics for participant sociodemographic characteristics. A total of 171 rural older adults

Table 1. Sociodemographic characteristics of rural, older Oklahoma participants in a cross-sectional study examining the interplay between indicators of physical health and emotional well-being on nutritional status

Variable	Frequency (N= 171)	Percentage	Mean ±standard deviation
Age (y)			77.5±8.2
Sex			
Male	51	29.8	
Female	120	70.2	
Race or ethnicity			
White	169	98.8	
Hispanic or Latino	1	0.6	
Asian	1	0.6	
Marital status			
Never married	3	1.8	
Married	83	49.7	
Widowed	70	41.9	
Divorced	9	5.4	
Separated	2	1.2	
Education			
Grade school or junior high	9	5.3	
Some high school	20	11.8	
High school or vocational	74	43.5	
Some college	31	18.2	
College	12	7.1	
Some postgraduate	17	10.0	
Master's degree or doctorate	7	4.1	
Annual income, \$			
<10,000	23	16.4	
10,000-19,999	40	28.6	
20,000-29,999	24	17.1	
30,000-39,999	18	12.9	
≥40,000	35	25.0	

(age range=65 to 101 years) participated in the study with an average age of 77.5 years. The majority of participants were women (70.2%) and white (98.8%). Close to half of participants were married (49.7%) and had at least a high school degree (43.5%). Forty-five percent of participants reported annual incomes <\$20,000, and 55% reported annual incomes ≥\$20,000.

Table 2 presents descriptive statistics (ie, mean, standard deviation, and range) for the variables used in the structural

equation model to examine the research hypotheses. Given that one of the important assumptions for using structural equation modeling analysis is the normality of the employed data, basic descriptive analyses were conducted to check skewness and kurtosis of the outcome variables used in the structural equation model. The results showed that all three dependent variables included in the structural equation model were adequately normally distributed (skewness <3 and kurtosis <7)³⁸ with no severe violation of normality. Zero-order correlation coefficients for the variables are also presented in Table 2. As shown in Table 2, there was a significant positive correlation between self-care capacity and perceived health status (Pearson $r=0.31$). Although there was a significant positive correlation between depressive affect and loneliness ($r=0.42$), depressive affect was negatively correlated with perceived health status ($r=-0.31$) and nutritional status ($r=-0.27$). More nuanced and complex relationships were examined using the structural equation model. Participants' response rates were relatively high, with a small missing data rate ranging from 1.1% to 8.1% across all measures used in the structural equation model. Given that no systematic missing data pattern was found, missing at random was assumed for further analyses. Full information maximum likelihood robust estimation method (estimator=MLR) in Mplus was used to obtain the parameter estimates by handling missing data in any outcome variables and adjusting the standard errors given nonnormality. A total of 168 participants after removing three respondents who had missing data on predictor variables, were included for further analysis by default using ESTIMATOR=MLR in Mplus 7.1.

Figure 2 presents the structural equation modeling results for the standardized parameter estimates with the model fit indexes. All of the model fit indexes supported the hypothesized model to fit the data. The χ^2 test was not significant ($\chi^2(2)=2.15$; $P=0.34$), indicating a good fit of the hypothesized model to the data, and other model fit indexes exhibited good fit as well (ie, CFI=1.00, RMSEA=0.02, and SRMR=0.03). Given the model fit was good, the parameter estimates for each hypothesis were interpreted. As shown in Figure 2, self-care capacity was significantly related to depressive affect ($\gamma=-0.11$; $P=0.03$), meaning that participants were more depressed as self-care capacity was more limited (H1), whereas self-care capacity was not significantly related with loneliness (H2). As hypothesized, perceived health status had a significant negative relationship with both loneliness ($\gamma=-0.16$; $P=0.03$) (H3) and depressive affect ($\gamma=-0.22$; $P=0.03$) (H4), indicating that lower perceived health status was related to higher loneliness and depressive affect. Although loneliness showed no significant direct relationship with nutritional status (H5), it showed a significant direct relationship with depressive affect ($\beta=.46$; $P<0.01$) (H6), indicating participants who were lonelier were more depressed. Finally, the results demonstrated that depressive affect had a significant negative relationship with nutritional status ($\beta=-.30$; $P<0.01$) (H7), meaning that participants who were more depressed were more likely to have poor nutritional status. This finding further supports the growing body of evidence linking poor nutritional status with an increased risk of depressive symptoms.^{6,26} Table 3 provides more detailed information on the estimated parameters, corresponding standard errors, and one-tailed P values.

Table 2. Descriptive statistics and correlations between self-care capacity, perceived health status, loneliness, depressive affect, and nutritional status in the structural equation model among rural, older Oklahomans

Variable	Descriptive Statistic				
	Perceived health status ^a	Self-care capacity ^b	Loneliness ^c	Depressive affect ^d	Nutritional status ^e
Correlation					
Self-Care Capacity	0.31*	—	—	—	—
Loneliness	-0.13	0.05	—	—	—
Depressive Affect	-0.31*	-0.14	0.42*	—	—
Nutritional Status	0.15	0.13	-0.07	-0.27*	—
Mean	9.75	38.38	18.09	1.36	12.09
Standard deviation	2.11	1.15	4.23	1.93	1.48
Minimum	4.00	33.00	10.00	0.00	8.00
Maximum	14.00	39.00	29.00	9.00	14.00
Skewness	—	—	0.17	1.83	-0.72
Kurtosis	—	—	-0.58	3.41	-0.07

^aMeasured using the Subjective Health Perceptions Scale.²⁹ Scores range from 4 to 14. A higher score represents higher perceived health.

^bMeasured using the Self-Care Capacity Scale.²⁹ Scores range from 13 to 39. A higher score reflects higher self-care capacity.

^cMeasured using the Loneliness Scale-Version.³⁰ Scores range from 10 to 29. A higher score indicates higher feelings of loneliness.

^dMeasured using the Geriatric Depression Scale.³¹ Scores range from 0 to 10 with a higher score indicating a higher depressive affect.

^eMeasured using the Mini-Nutritional Assessment Short-Form.³² Scores range from 0 to 14. A higher score indicates high nutritional status.

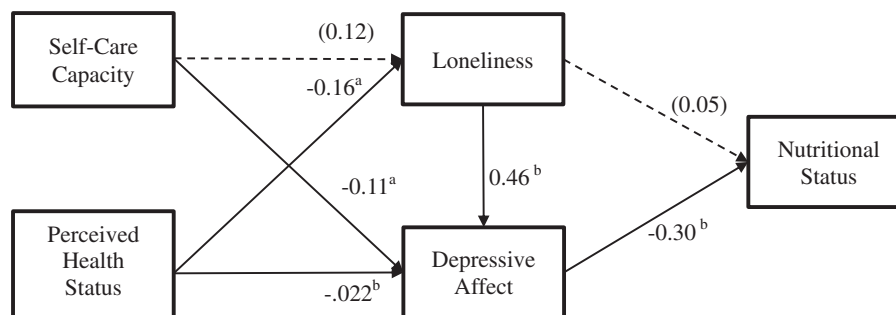
*Significant at $P < 0.01$.

DISCUSSION

The specific aim of this study was to examine the interplay between indicators of physical health (perceived health status and self-care capacity) and emotional well-being (depressive affect and loneliness) with rural older adults' nutritional status. To gain a holistic understanding of these

complex relationships, the present study adopted MODEL as a fundamental framework.

The present study hypothesized that poor physical health status (impaired self-care capacity and low perceived health status) would have a direct negative relationship with emotional well-being (loneliness and depressive affect).



Model Fit

Chi-square (df ^c)	2.14 (2), p=0.34
CFI ^d	1.00
RMSEA ^e	0.02
SRMR ^f	0.03

Figure 2. Structural equation modeling results with standardized parameter estimates and model fit indexes. All path coefficients are standardized. Numbers are standardized parameter estimates. Dotted lines represent $P > 0.05$ or $P > 0.01$, and solid lines represent $P < 0.05$ or $P < 0.01$. ^aSignificant at $P < 0.05$. ^bSignificant at $P < 0.01$. ^cdf=degree of freedom. ^dCFI=comparative fit index. ^eRMSEA=root mean square error of approximation. ^fSRMR=standardized root mean square residual.

Table 3. Summary of parameter estimates for the relationship of physical health, emotional well-being, and nutritional status among older adults residing in rural Oklahoma

Path	Parameter estimate \pm standard error	One-tailed <i>P</i> value
H1: Self-care capacity \rightarrow depressive affect	-0.11 ± 0.06	0.033
H2: Self-care capacity \rightarrow loneliness	0.12 ± 0.08	0.063
H3: Perceived health status \rightarrow loneliness	0.16 ± 0.08	0.027
H4: Perceived health status \rightarrow depressive affect	-0.22 ± 0.07	0.002
H5: Loneliness \rightarrow nutritional status	0.05 ± 0.10	0.302
H6: Loneliness \rightarrow depression	0.46 ± 0.07	0.001
H7: Depression \rightarrow nutritional status	-0.30 ± 0.10	0.001

Although the hypothesis related to loneliness was not supported in the present study, rural older adults with impaired self-care capacity had higher depressive affect. Similarly, previous studies have reported that older adults who experience difficulties in performing daily activities are at increased risk of depression.^{39,40} This finding suggests that impaired self-care capacity may affect older adults' ability to participate in social activities with others, which may lead to social isolation. In turn, inability to maintain daily activities due to impaired self-care capacity can increase the risk of depression.^{13,18,41}

Findings from this study also indicate rural older adults with lower perceived health status experience greater feelings of loneliness and depressive affect. A negative association between perceived health status, loneliness, and depressive affect has been frequently reported in previous studies.^{13,16,17} A meta-analysis that included quantitative as well as qualitative studies identified poor self-perceived health as a strong risk factor for depression among older adults.⁴² In addition, the present study hypothesized that loneliness would have a direct positive relationship with depressive affect. Results from this study extend the previous findings by confirming that loneliness is also a strong predictor of depressive affect among rural older adults.^{18,19,43} This finding suggests that feeling lonely might potentially be a risk indicator of a depressed mood state.

The present study hypothesized that poor emotional well-being would negatively influence nutritional status. Although loneliness did not directly influence nutritional risk, depressive affect did have a direct negative relationship with nutritional status. This finding is consistent with those of recent studies conducted with both hospitalized and community-dwelling older adults.^{6,44} Although depression has been shown to be a major predictor of nutritional status in older adults, the mechanism of this negative relationship between depression and nutritional status has not been fully investigated.^{44,45} However, one proposed hypothesis explains that depression may influence motivation to eat and suppress appetite.⁴⁶ As a consequence of reduced food intake, older adults may experience weight loss, which in turn may lead to a higher incidence of nutritional risk. Conversely, poor nutrition itself has been proposed as a predictor of depression as a result of lack of nutrients such as folate and vitamin B-12 that are required for neurotransmitter changes,^{14,47}

suggesting that the association between depression and nutrition risk may be bidirectional.

Although many previous studies have examined the nutritional risk factors associated with emotional well-being and physical health, there is limited research exploring the complex interplay between indicators of physical health and emotional well-being on rural older adults' nutritional status. The present study may be the first to investigate both physical and emotional well-being as risk factors on nutritional status. The results from the present study revealed that nutritional status is directly influenced by emotional well-being and this emotional well-being is also strongly associated with physical health status. Unfortunately, rural older adults have been reported to experience higher levels of loneliness, depressive symptoms, and poorer health status compared with urban older adults.^{22,48} Thus, the combined experience of poor emotional well-being and impaired physical health status put rural older adults at greater risk of malnutrition.

Several studies have reported that providing social support has a protective effect against impaired physical health in old age. Social support is also believed to act as a buffer against the negative consequences of depressive symptoms on impaired self-care capacity.⁴⁹ In fact, previous studies reported socialization opportunities provided by the Older Americans Act Nutrition Program helped alleviate older adults' depressive symptoms and feelings of loneliness and increased their perception of health and appetite due to having others to eat with in a social atmosphere.⁵⁰

Thus, findings from the present study imply that providing health promotion programs for rural older adults that include efforts to promote emotional well-being as well as to provide social support, particularly for those with limited self-care capacity, could improve nutritional status. One venue to provide health promotion programs for rural older adults is the Older Americans Act Nutrition Program, which provides not only nutritious meals but also offers many opportunities for older adults to socialize. Including both physical and emotional well-being components into senior nutrition programs could possibly decrease the risk of malnutrition, prevent physical and emotional decline, and ultimately assist rural older adults in maintaining their health and ability to live independently in their communities.

Although results from the present study provide insights into the importance of both physical and emotional well-

being on nutritional status, it has several limitations. First, selection bias might have affected the results of the present study. Study participants were selected using convenience sampling, which may have resulted in a homogenous participant pool. Furthermore, convenience sampling may have introduced a selection effect whereby participants may represent older adults who are in better emotional and physical health than the general population. For future studies, using randomized sampling would result in greater heterogeneity. Second, although there is a growing body of evidence showing that the association between poor nutrition and an increased risk of depressive symptoms is bidirectional, the present study used a cross-sectional methodology. Therefore, it is not appropriate for exploring causal relationships between the variables. Third, the study used a geographically limited sample recruited from north-west Oklahoma. Therefore, findings from the present study cannot be generalized to rural older adults elsewhere.

CONCLUSIONS

With the rapidly increasing older adult population, health promotion programs aimed at improving nutritional status can play an important role in successful aging.

Older adults residing in rural areas are at increased risk of poor nutritional status, which is influenced by multidimensional aspects encompassing physical and emotional well-being. Identifying factors influencing nutritional status is critical when health care professionals plan programs to assist older adults in achieving and maintaining optimal nutritional status. Our findings suggest that physical and emotional well-being should be addressed together. This is particularly important for rural older adults with impaired physical health and self-care capacity to reduce potential effects of poor emotional well-being on nutritional status.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT

Funding for the present research was provided by the Donna Cadwalader Research and Development Grant. Research reported in this article is supported in part by the National Institute on Aging (grant no. K01AG045342).