Exploring the pathways between depression, anxiety, stress, and quality of life on life satisfaction: a path analysis approach

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Abstract

Background Life satisfaction, one promising health asset, is associated with reduced risk of several chronic diseases and mortality. Mental health conditions and quality of life (QoL) are important aspects of well-being in late life and are significantly associated with life satisfaction. Despite the complex interrelationships between mental health, QoL and life satisfaction, the current literature has evaluated the simple association between them and failed to consider the complex pathways among these variables, especially among the older population. Hence, this study explores the pathways between mental health conditions (depression, anxiety, and stress), QoL and life satisfaction among older adults in eastern Nepal.

Methods This cross-sectional study was conducted in eastern Nepal via face-to-face interviews with 847 older adults selected by multi-stage cluster sampling. The 5-item Satisfaction with Life Scale and 13-item Older People's QoL scale assessed life satisfaction and QoL, respectively. The 21-item Depression, Anxiety and Stress scale measured mental health conditions. The relationship between QoL, depression, anxiety, and stress with life satisfaction was first evaluated using linear regression, subsequently by path analysis.

Results The mean ($\pm$ SD) life satisfaction and QoL score were 19.7 ($\pm$ 5.3) and 42.9 ($\pm$ 7.1), respectively. More than one-fifth of the participants had moderate to severe depression (30%), anxiety (34%), and stress (20%). In adjusted regression analysis, QoL was positively associated (β: 0.44; 95% CI: 0.40 to 0.48) with life satisfaction, whereas depression, anxiety, and stress were inversely associated. In the path analysis, the relationship between depression and stress with life satisfaction was mediated by QoL. Depression was indirectly related to life satisfaction (mediated by QoL, $\beta = -0.25$), whereas stress was both directly ($\beta = -0.11$) and indirectly (mediated by QoL, $\beta = -0.08$) related to life satisfaction.

Conclusions Given the high mental health burden among the older Nepali population and its potential impact on life satisfaction and QoL, routine screening for mental health should be encouraged in clinical practice. Additionally,

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Yadav *et al. BMC Geriatrics* (2024) 24:1025

Page 2 of 10

community-based interventions and mental health promotion programs should be launched at regional and local levels.

Keywords Anxiety, Depression, Stress, Quality of life, Life satisfaction, Nepal, Older adults

Introduction

Globally, the proportion of older adults is increasing, with the World Health Organization (WHO) estimating that by 2050, 80% of the aging population will be in low- and middle-income countries [1]. In Nepal, a South Asian country between India and China, adults aged 60 and over make up 8.1% (2.5 million) of the population [2]. Life expectancy in Nepal has increased drastically over the past few decades, from 54 years in 1990 to 71 years in 2020 [3]. National data shows the older population is growing at 3.5%, outpacing the national growth rate of 1.35% [4], and projections suggest 10.8% of the population will be 60 or older by 2030 [5]. This demographic shift calls for investments in social, economic, and healthcare initiatives tailored to older adults. Nepal currently offers some support, including a monthly allowance of Rs 4,000 (U.S. $29.74) for seniors over 68, a social security budget, and the 2006 Senior Citizen Act, which prioritizes older adult's healthcare [6–8]. However, program sustainability and coverage remain challenges, especially in rural areas where over 80% of older Nepalis live [9], and there is limited research on the health and well-being of this population.

Life satisfaction is a broad social construct to assess the overall subjective well-being of an individual that measures the coherence between the people's life goals and their present state of affairs [10, 11]. It is one promising health asset associated with reduced risk of several chronic diseases and mortality [12–14]. Furthermore, the WHO and the United Nations are urging nations to use life satisfaction as an indicator for informing policy decisions, and several countries have moved in that direction [15–18]. Although Nepal has not yet adopted such measures, initial studies have examined life satisfaction among older Nepali adults [19–21]. Given the varied ways individuals evaluate their lives based on social, health, and economic factors, further research on life satisfaction among older Nepalis is warranted [22, 23], more studies on the life satisfaction of Nepali older adults are required.

Evidence suggests that depression and quality of life (QoL) are important predictors of life satisfaction among older adults [24–26], with depressive symptoms strongly associated with lower life satisfaction even after adjustment for physical health [19, 27]. Similarly, higher QoL is linked to greater life satisfaction [24, 25]. While life satisfaction and QoL are related, they are distinct constructs within well-being research [28, 29], as seen in frameworks like bottom-up and top-down theories [28, 29], which suggest that improved QoL enhances life satisfaction, and vice versa [24, 25, 28–30]. However, while life satisfaction is shown to predict QoL [30], there is less research on the reverse relationship, especially in older adults. Although there is a plausible complex interaction between mental health, QoL, and life satisfaction, existing literature typically examines these variables in isolation without addressing their complex pathways, particularly in older populations. To the best of our knowledge, previous studies have not considered a pathway approach to understanding the mediating role of QoL in the relationship between mental health and life satisfaction among older adults. This study, therefore, explores the pathways between mental health (depression, anxiety, and stress), QoL, and life satisfaction among older adults in eastern Nepal.

Methods

Study design, sample, and sampling

A cross-sectional study was conducted between July and September 2020 in rural settings of two districts (Morang and Sunsari) of Province 1 in eastern Nepal. The sample size of 847 was calculated based on an unknown prevalence of stress at 50%, a 5% margin of error at 95% significance and a 10% non-response rate [31]. Sampling included multi-stage cluster sampling, whereby two rural municipalities from each district were randomly selected in the first step. Subsequently, four wards in each municipality were selected randomly based on probability proportional to size. The sampling frame was obtained from ward offices of the respective municipalities. Eligibility criteria were: Nepali nationals aged 60 and above, at least one year of residence in the study area, and the ability to understand survey instructions. The details of the subjects' recruitment are published elsewhere [31].

Data collection and variables

Eight trained enumerators collected data via face-to-face interviews using the KoBo Toolbox application, which is pre-installed on tablets and synchronized online [32]. Standard validated tools, as described below, measured dependent and independent variables. Initially prepared in English, the questionnaire was translated into Nepali and then independently back-translated into English to check its face validity. Due to the onset of COVID-19 at the time of this survey, questionnaires were pre-tested on volunteers similar to the anticipated cohort, and minor editorial revisions were made.

Dependent variable

Life satisfaction

Satisfaction with Life Scale (SWLS), a widely used standard tool, measured participants' satisfaction with life [10]. The scale captures participants' agreement or disagreement on five items on subjective well-being on a 7-point Likert scale (1=strongly disagree and 7=strongly agree). In this study, the cumulative score (range 5 to 35) was calculated, where a higher score indicates higher levels of life satisfaction. The tool is previously validated and widely used across countries and cultures [10]. The tool, previously used in Nepal [19], has a Cronbach's alpha of 0.89 in the current study, suggesting the scale is reliable among our participants.

Independent variables of interest

Quality of life was measured using the short version of the Older People's Quality of Life (OPQOL) tool [33]. The OPQOL questionnaire comprises 13 items that capture participants' agreement/disagreement on a 5-point Likert response scale (1=strongly disagree to 5=strongly agree). The scores for the 13 items are summed to obtain the total OPQOL score, which ranged between 13 and 65, whereby higher scores represent higher QoL. The tool has been used widely and validated across cultures [34, 35]. The tool was highly reliable in our study, as indicated by a Cronbach alpha of 0.91.

Depression, anxiety, and stress

The 21-item Depression, Anxiety, and Stress Scale (DASS-21) [36] measured the three independent variables of interest: depression, anxiety, and stress. Each sub-scale (i.e., depression, anxiety, and stress) contains seven items on a four-point Likert scale (0=did not apply to me at all and 3=applied to me very much, or most of the time). Briefly, the depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale assesses difficulty relaxing, nervous arousal, easily upset/agitated, irritable/overreactive, and impatient. The items relevant to each of the three subscales are summed up to obtain the cumulative scores for depression (ranges: 0–21), anxiety (ranges: 0–21), and stress (ranges: 0–21), respectively. The cumulative score for each was used in the path analysis. However, for the linear regression, depression, anxiety, and stress were each classified into normal, moderate, and severe following the recommended cutoff [37]. The Nepali version of DASS-21 has been validated by two previous studies that demonstrated adequate psychometric properties of the scale [38, 39]. In the current study, the Cronbach alpha for the depression, anxiety, and stress

subscales were 0.93, 0.87, and 0.87, respectively, indicating the scales to be reliable among our participants.

Control variables

In analyzing the relationships between QOL, depression, anxiety, stress, and life satisfaction, controlling for age, sex, marital status, education level, ethnicity, religion, occupation, family type, and dependency on family (for living and daily activities) is essential. Age and sex are foundational demographic factors influencing psychological well-being, as different life stages present unique challenges, and sex differences are observed in the prevalence of depression and anxiety [40, 41]. Marital status and family type shape social support networks, directly impacting life satisfaction [41]. Education level and occupation are indicators of socioeconomic status, which significantly influence mental health and quality of life [42]. Additionally, ethnicity and religion contribute to cultural values and coping mechanisms, shaping individuals' perceptions of life satisfaction [41]. Lastly, dependency on family for living and daily activities, measures of social support, affects autonomy and plays a crucial role in understanding available social support, directly influencing both mental health and life satisfaction [40].

The responses for each control variable are provided in Table 1. Briefly, marital status was dichotomized into being married and without a partner; the latter included those widowed, separated, and never married. Education variable had three categories: "no education" (could not read or write), "informal" (those who attended some informal classes or training and could read and write in Nepali), and "formal education" (those attending formal schools). Ethnic groups were identified using Nepal's Health Management Information System (HMIS) classification [43]. They were recategorized into three groups: Dalit and religious minority, disadvantaged group, and upper caste. Nepal's local context considers the first two ethnic groups relatively disadvantaged.

Statistical analyses

SAS Version 9.4 [44] was used for data analyses. Univariate statistics (frequency, proportion, mean and standard deviation) were generated to summarize the variables depending on their type. Bivariate analyses summarized differences in life satisfaction scores across independent variables. Pearson correlation coefficients were calculated between the independent variables of interest (QoL, depression, anxiety, and stress) and outcome (life satisfaction). The relationship between QoL, depression, anxiety, and stress with life satisfaction was first evaluated using linear regression, subsequently by path analysis. Stepwise regression based on the Akaike information criterion (AIC) criteria was used for model selection. The initial model began with all the control variables listed

Yadav *et al. BMC Geriatrics*   (2024) 24:1025

Page 4 of 10

Table 1 Characteristics of participants- overall and by average life satisfaction score

Characteristics	n (%)	Life satisfaction (Mean ± SD)	p-value
Overall	847	19.7 ± 5.3	
Age, years			
60–64	290 (34.2)	20.3 ± 4.8	**< 0.001**
65–69	283 (33.4)	20.1 ± 5.1	
70 and above	274 (32.3)	18.7 ± 5.7	
Sex			
Male	469 (55.4)	19.7 ± 5.1	0.833
Female	378 (44.6)	19.8 ± 5.4	
Marital status			
Married	647 (76.4)	19.9 ± 5.2	0.114
[1]Without a partner	200 (23.6)	19.2 ± 5.3	
Education status			
No education	472 (55.7)	19.7 ± 5.5	**0.008**
Informal education	284 (33.5)	19.4 ± 4.6	
Formal education	91 (10.7)	21.3 ± 5.6	
Ethnicity			
Dalit & minority	164 (19.4)	18.2 ± 5.5	**< 0.001**
Disadvantaged	554 (65.4)	20.1 ± 4.9	
Upper caste groups	129 (15.2)	19.9 ± 6.0	
Religion			
Hindu	808 (95.4)	19.7 ± 5.2	0.591
Non-Hindu	39 (4.6)	20.2 ± 5.4	
Occupation			
Agriculture	167 (19.7)	20.2 ± 4.9	**< 0.001**
Business or job	95 (11.2)	20.5 ± 5.3	
Retired and others	231 (27.3)	18.5 ± 4.6	
Unemployed	354 (41.8)	20.1 ± 5.7	
District			
Morang	438 (51.7)	19.8 ± 5.6	0.786
Sunsari	409 (48.3)	19.7 ± 4.8	
Family type			
Single	155 (18.3)	20.3 ± 5.7	0.113
Joint	692 (81.7)	19.6 ± 5.2	
Dependency on family for living			
No	193 (22.8)	20.3 ± 6.0	0.076
Yes	653 (77.2)	19.6 ± 5.0	
Dependency on family for daily activities			
No	456 (53.8)	20.9 ± 5.7	**< 0.001**
Yes	391 (46.2)	18.4 ± 4.3	
Depression			
Normal	593 (70.0)	20.4 ± 4.8	**< 0.001**
Moderate	162 (19.1)	18.2 ± 5.8	
Severe	92 (10.9)	18.4 ± 5.9	
Anxiety			
Normal	559 (66.0)	20.3 ± 4.8	**< 0.001**
Moderate	140 (16.5)	18.9 ± 6.9	
Severe	148 (17.5)	18.3 ± 4.8	
Stress			
Normal	670 (79.1)	20.2 ± 5.0	**< 0.001**

Table 1 (continued)

Characteristics	n (%)	Life satisfaction (Mean ± SD)	p-value
Moderate	151 (17.8)	17.9 ± 5.7	
Severe	26 (3.1)	19.5 ± 6.6	

[1] Includes widowed, separated, and never married. Significant p-values are bolded

in Table 1, and the final model was adjusted for age, ethnicity, religion, occupation, and family dependency for daily activities. Adjusted and unadjusted beta coefficients and 95% confidence intervals from linear regressions are reported in Table 2. Multicollinearity was tested in terms of the variance influence factor (VIF). All the variables in the model had VIF less than 2.5 suggesting that multicollinearity was not concerning. Statistical significance was set at 0.05.

For the path analysis, the CALIS procedure in SAS was used. Path analysis is a valuable analytical method when the goal is to examine both direct and indirect relationships among observed variables in a simple and intuitive manner. Unlike structural equation modeling (SEM), which involves latent variables and adds complexity, path analysis focuses solely on measured variables, making the results easier to interpret. It also efficiently handles mediation by capturing direct and indirect effects within a single framework, offering a more streamlined alternative to conducting separate mediation analyses. Additionally, path analysis requires smaller sample sizes compared to SEM, while providing clearer insights into causal pathways through its more straightforward model. The initial model assumed an interrelationship between all independent variables of interest and life satisfaction (Supplemental Fig. 1). However, the final model was developed based on the Lagrange Multiplier test and the Wald test. The path models were assessed using chi-square goodness of fit, standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), and Bentler comparative fit index (CFI). The chi-square statistic tests the null hypothesis that the theoretical model fits the data. Thus, a larger p-value (>0.05) suggests a close fit. Likewise, RMSEA and SRMR values less than 0.09 suggest a fair fit or adequate approximation error. In contrast, values less than 0.055 suggest a small error or better fit. CFI values greater than 0.94 suggest a good fit between data and hypothesized models [45].

Results

Descriptive statistics of sociodemographic profile

The mean age of participants was 68.0 ± 7.1 years. The majority of the participants were males (55.4%), married (76.4%), without any education (55.7%), belonged to a disadvantaged ethnic group (65.4%), and followed the Hindu religion (95.4%). Four in five lived in a joint

Yadav *et al. BMC Geriatrics* (2024) 24:1025

Page 5 of 10

Table 2 Means, standard deviations, and intercorrelations (Pearson correlation coefficients) between variables in path analysis

	Mean	SD	Pearson correlation coefficients***			
			Life satisfaction	QoL	Depression	Anxiety
QoL	42.9	7.1	0.61			
Depression	3.6	4.3	-0.20	-0.35		0.88
Anxiety	3.4	3.6	-0.18	-0.33		
Stress	4.4	3.8	-0.24	-0.35	0.86	0.86

Abbreviation- QoL: Quality of life, SD: standard deviation. *** All correlation coefficients were significant at $p < 0.001$

Table 3 Linear regression for the association between independent variables of interest and life satisfaction

Independent variables of interest	Unadjusted β[1] (95% CI)	Adjusted β[2] (95% CI)
Quality of life	**0.45 (0.41, 0.49) *** **	**0.44 (0.40, 0.48) *** **
Depression		
Normal	Reference	Reference
Moderate	**-2.19 (-3.09, -1.29) *** **	**-2.81 (-3.72, -1.90) *** **
Severe	**-1.94 (-3.08, -0.81) *** **	**-2.64 (-3.75, -1.52) *** **
Anxiety		
Normal	Reference	Reference
Moderate	**-1.48 (-2.44, -0.52) ** **	**-1.49 (-2.41, -0.56) ** **
Severe	**-2.00 (-2.94, -1.06) *** **	**-2.71 (-3.68, -1.74) *** **
Stress		
Normal	Reference	Reference
Moderate	**-2.31 (-3.23, -1.39) *** **	**-2.74 (-3.66, -1.82) *** **
Severe	-0.71 (-2.74, 1.33)	-1.68 (-3.64, 0.27)

Significant coefficients are bolded. **$p < 0.01$, ***$p < 0.001$. [1]β is the regression coefficient indicating the change in life satisfaction for each one-unit increase in the predictor, with other variables held constant. A positive β means satisfaction increases, while a negative β signals a decrease. [2]Based on the Akaike information criterion, the model was adjusted for age, ethnicity, religion, occupation, and family dependency for daily activities

family (81.7%), and about 77% and 46% of the participants depended on family for living and daily activities, respectively. About 30% of the participants had moderate to severe depression, 34% had moderate to severe anxiety, and about 20% had moderate to severe stress (Table 1).

Descriptive statistics of dependent and independent variables

The mean life satisfaction score ($\pm$SD) was 19.7$\pm$5.3. In bivariate analyses, the average life satisfaction score was significantly associated with age, ethnicity, education, occupation, family dependence on daily activities, morbidity status, depression, anxiety, and stress ($p < 0.001$) (Table 1).The results in Table 3 show that life satisfaction was significantly and positively correlated with QoL ($r = 0.61$, $p < 0.001$), whereas depression ($r = -0.20$, $p < 0.001$), anxiety ($r = -0.18$, $p < 0.001$) and stress ($r = -0.24$, $p < 0.001$) showed a weak negative correlation.

Factors associated with life satisfaction

In the final adjusted model, controlling for age, ethnicity, religion, occupation, and family dependency for daily activities, all independent variables of interest, i.e., QoL,

depression, anxiety, and stress, were significantly associated with life satisfaction (Table 2).

After adjusting control variables, a unit increase in QoL score increased life satisfaction by 0.44 units (adjusted β: 0.44; 95% CI: 0.40 to 0.48, $p < 0.001$). Depression, anxiety, and stress were inversely associated with life satisfaction. Older adults with moderate and severe symptoms of depression had 2.81 (adjusted β: -2.81; 95% CI: -3.72 to -1.90, $p < 0.001$) and 2.64 (adjusted β: -2.64; 95% CI: -3.75 to -1.52, $p < 0.001$) times lower life satisfaction score respectively than those without depressive symptoms. Likewise, those with moderate (adjusted β: -1.49; 95% CI: -2.41 to -0.56, $p < 0.001$) and severe (adjusted β: -2.71; 95% CI: -3.68 to -1.74, $p < 0.001$) score of anxiety and moderate stress (adjusted β: -2.74; 95% CI: -3.66, -1.82, $p < 0.001$) had lower life satisfaction score than their counterparts (Table 2).

Path analysis

Figure 1 shows significant pathways of the final model and their goodness-of-fit indices. All goodness of fit indices, i.e., non-significant chi-square test ($\chi 2 = 1.778$, df = 2, $p = 0.411$), smaller values of residual (RMSEA < 0.001 and SRMR = 0.002), and CFI greater than 0.94, suggesting that the final model reasonably fits the data.

All path coefficients shown in Fig. 1, except the path between anxiety and life satisfaction were statistically significant (Table 4; Fig. 1). QoL (β = 0.58; $p < 0.001$) and stress (β = -0.11; $p = 0.040$) had a significant direct relationship with life satisfaction, whereas the direct pathway between depression and life satisfaction was not supported. Depression indirectly contributed to life satisfaction through QoL (β = -0.25; $p < 0.001$). In addition to significant direct effects, the relationship between stress and life satisfaction was also mediated by QoL (β = -0.08; $p < 0.05$) (Fig. 1).

Table 5 shows the direct, indirect and total effects of depression, anxiety, and stress on life satisfaction. Depression (β = -0.25) and anxiety (β = -0.09) were found to be indirectly related to life satisfaction (mediated by QoL), whereas stress was both directly (β = -0.11) and indirectly (mediated by QoL, β = -0.08) related to life satisfaction.
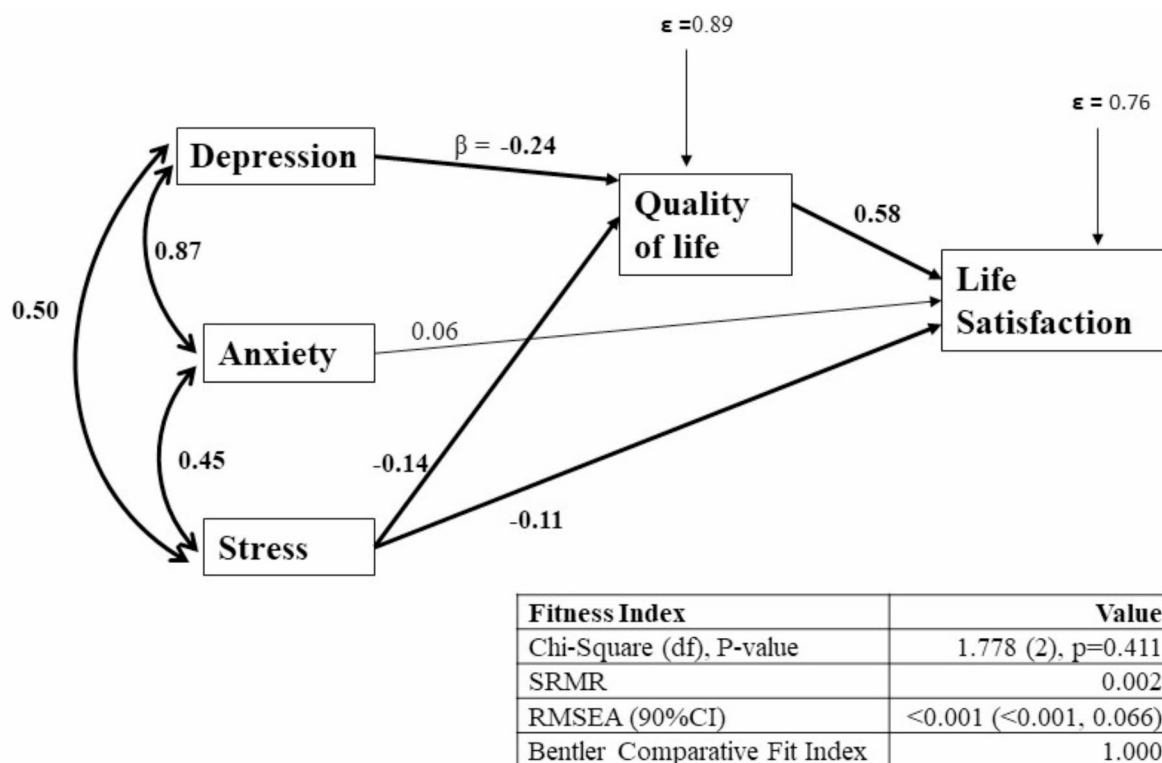
Fig. 1 Pathway between depression, anxiety, stress, quality of life and life satisfaction (final model). Single-headed arrows indicate directional relationships, showing the hypothesized influence of one variable on another. Bold arrows highlight pathways found to be statistically significant in the path analysis. The final model is adjusted for age, ethnicity, marital and educational status, and family dependency for daily activities. **β (Beta)** represents the standardized regression coefficient, indicating the strength and direction of the relationship between the variables. Positive values indicate a direct relationship, while negative values indicate an inverse relationship. **ε (Epsilon)**: Denotes the error term, which accounts for the unexplained variance in quality of life and life satisfaction. **Fitness Index Values**: **Chi-Square** tests the fit of the model to the data, with a non-significant p-value suggesting good model fit. **SRMR (Standardized Root Mean Square Residual) i**ndicates the average discrepancy between observed and predicted correlations, with values closer to 0 showing a better fit. **RMSEA (Root Mean Square Error of Approximation)** reflects the model's goodness-of-fit, with values < 0.05 indicating a close fit. **Bentler Comparative Fit Index** compares the model's fit to a baseline model, with values closer to 1 indicating a better fit

Table 4 Relationship between independent and dependent variables in path analyses

Independent variables		Dependent variables	Estimate (β)	95% CI	*p*-value
Quality of life	----- ->	Life satisfaction	0.58	0.53, 0.63	**< 0.001**
Depression	----- ->	Quality of life	-0.24	-0.37, -0.12	**< 0.001**
Anxiety	----- ->	Life satisfaction	0.06	-0.04, 0.17	**0.233**
Stress	----- ->	Life satisfaction	-0.11	-0.21, -0.01	**0.040**
Depression	----- ->	Anxiety	0.87	0.85, 0.89	**< 0.001**
Depression	----- ->	Stress	0.50	0.44, 0.56	**< 0.001**
Anxiety	----- ->	Stress	0.45	0.39,0.51	**< 0.001**
Stress	----- ->	Quality of life	-0.14	-0.27,-0.02	**0.021**

The arrow (----- ->) represents the direct causal path from the independent variable to the dependent variable. "Standardized Estimate (β)" represents the standardized regression coefficient, indicating the strength and direction of the relationship between the independent and dependent variables

Discussion

Nepal's National Health Policy (2014) aims to deliver quality health services to all citizens and provide basic health services free of cost [46], and the National Mental Health Strategy and Action Plan (2020) describes the provision of free primary care mental health services for all parts of the country [47]However, the government of Nepal's commitment to addressing the unmet needs of the aging population is not up to par. This research found that higher QoL scores were associated with better life satisfaction, whereas higher depression, anxiety, and stress scores were associated with lower life satisfaction. Furthermore, in the path analysis, QoL mediated the relationship between depression and life satisfaction.

Table 5 Total, direct and indirect effects of independent variables on life satisfaction

	Total Effect	Direct Effect	Indirect Effect
Depression	-0.25***	0.00	-0.25***
Anxiety	-0.02	0.06	-0.09***
Stress	-0.19***	-0.11*	-0.08*

*$p<0.05$, ***$p<0.001$. "Total Effect" is the sum of direct and indirect effects and indicates the overall influence of the independent variable on life satisfaction. "Direct Effect" represents the immediate impact of the independent variable on life satisfaction, without mediation. "Indirect Effect" shows the impact of the independent variable on life satisfaction that is mediated through other variables

Better QoL was associated with better life satisfaction, a finding consistent with the literature [24, 25, 30, 48]. Those with the highest levels of QoL reported being satisfied with their life [24, 25]. Among Turkish older adults, life satisfaction positively predicted QoL [30]. The plausible reason could be that older adults in community settings have emotional stability, engagement, positive emotion and relationships, productivity, resilience and self-esteem that might have uniquely flourished their QoL. This could have influenced the perception that life is going well, positively impacting subjective happiness on the life satisfaction scale.

Our finding of an inverse association between mental health conditions and life satisfaction, i.e., poor mental health leads to lower life satisfaction, is consistent with the literature [19, 27, 49–51]. Lower life satisfaction in older adults is attributed to poor mental health [19, 27, 50]. Even after adjustment for physical health characteristics, depressive symptoms are strongly associated with lower life satisfaction [27]. A previous study from Nepal reported older adults with higher depression scores had lower life satisfaction [19]. Likewise, among older adults with chronic pain in Sweden, anxiety or depression disorders had a negative relationship with life satisfaction [51]. In fact, life satisfaction is negatively associated with depression, anxiety, and/or stress for all age groups, including the oldest old [49], young adults [52, 53] and adolescents [54]. Depressive symptoms impact perceived subjective feelings, self-esteem and self-worth, as well as health behaviors such as physical activity, healthy diet, and medication adherence [55]. They also induce higher levels of distress and loneliness, all of which ultimately impact an individual's satisfaction with life [56]. Another possible explanation could be that depression in older adults impairs daily functional activity and increases their dependency on caregivers or family members [57, 58]. This, in turn, deteriorates their state of well-being, which may have contributed to the decreased perceived self-worth of our participants on the life satisfaction scale. Moreover, in Nepal, the mental health and life satisfaction of marginalized communities, such as Madhesi, Dalits, and Indigenous groups, is often affected by limited access to socioeconomic and cultural resources.

However, cultural factors like family support, community networks, and participation in cultural events (e.g., *Dashain*, *Deepawli*, *Joorshital*, *Chaath*) can enhance mental health and life satisfaction. Social activities, such as community gatherings, arts, ceremonies, and volunteering, foster a sense of belonging and inclusion, ultimately improving well-being among older adults. These activities were partially disrupted during COVID-19, though marginalized communities demonstrated resilience. Future research should explore the relationships between mental health (e.g., depression, anxiety) and life satisfaction in older adults, while identifying protective factors.

Furthermore, in addition to directly affecting life satisfaction, QoL mediated the pathway between depression and life satisfaction. The potential link between depression and QoL is well evident in the literature, as depression in older population is one of the prime factors that determine the QoL in that population. Consistent with our findings, poor mental health decreases QoL in older populations [59–61]. A previous finding from urban Nepal also reported that depression score was negatively associated with QoL among Nepali older adults [61]. Notably, one component of the OPQOL tool is social support and previous literature support that social support buffers the impact of depressive symptoms on life satisfaction in old age [59]. In later life, support from friends and family helps adapt to physical, biological, and social changes. It also acts as a buffer to help older adults cope with symptoms of depression and/or the impact of depression on perceived well-being and life satisfaction [59].

Strengths, limitations, and future research directions

This pioneering study explored the pathways between mental health, QoL and life satisfaction among Nepali older adults. To our knowledge, these pathways among older adults have not been previously explored in any context. Large sample size with a response rate of more than 90% and the involvement of locally trained enumerators who understand the local culture dynamics and language with years of experience in fieldwork as surveyors add to the strengths of this research. Notably, the research lead and few other research team members have lived marginalization experience similar to those of the studied population which ensures that findings are interpreted within local socio-cultural lens.

Nonetheless, this study has the following limitations: (i) Data collection was done during the COVID-19 pandemic, a period with unique challenges, such as social restrictions, economic uncertainty, and health concerns, that may have significantly influenced the participant's response, findings should be interpreted with caution, (ii) cross-sectional study design; therefore, no causal inferences can be made, (iii) Although we used a validated

tool to measure depression, anxiety and stress, given that mental health is highly stigmatized in Nepal [62], their measures may be underestimated due to the possibility of social desirability bias (iv) our study was limited to two districts with small geographic regions, which restricts the generalizability of the findings to other settings and ethnic groups (e.g., urban, hilly, or Himalayan regions and diverse ethnic groups).

Further prospective studies are needed to identify the direction of these pathways. While we conceptualized the pathway from QoL to life satisfaction, further rigorous large-scale research embedding a multimethod or mixed-method approach with an opportunity for participants to anonymously report well-being parameters required to investigate the interactions between QoL and life satisfaction from bidirectional perspectives.

Policy and practice implications

Despite the above-noted limitations, this study has significant clinical implications for older populations' health and well-being, particularly in low-resource settings. As an important health indicator to assess the overall subjective well-being of an individual, understanding the determinants of life satisfaction is essential to promote overall well-being. Specifically, given the high mental health burden among the older Nepali population, as quantified by the current and previous studies [61], and its potential impact on life satisfaction and QoL; routine screening for mental health should be encouraged in primary health care for the ageing population. Training community health workers to identify and manage common mental health issues can improve access to care, especially in rural and underserved areas where specialized services are often unavailable. As a trusted community member, these workers can also serve as liaisons between traditional healing systems and modern mental health services, fostering culturally acceptable care. Additionally, as the government of Nepal is on the verge of devising a geriatric health policy, prioritizing the prevention and management of depression in a national health strategy is essential. This policy should include key performance indicators for primary healthcare services to address mental health effectively. Our findings emphasize the importance of mental health assessments at secondary and tertiary care levels, where healthcare providers can evaluate mental health using validated scales and tailor interventions to mitigate adverse mental health impacts, especially for marginalized groups who may face greater barriers to accessing care. Addressing mental health literacy, reducing stigma, and strengthening referrals are also critical and should be incorporated into national policy; empowering community health workers to support older adults could significantly enhance care accessibility. Public health campaigns and mental health literacy initiatives can help normalize conversations about mental health, thereby encouraging help-seeking behavior.

While Nepal's Community Mental Health Care Package 2074 (2017) aims to integrate mental health into primary care, its implementation faces barriers, including limited human resources and funding [47, 63]. Additionally, Nepal's robust traditional healing system, rooted in religious and cultural practices, should be considered in mental health program design, as traditional and faith-based healers use culturally specific spiritual practices to address psychological issues among diverse communities [47]. Mental health initiatives should also focus on reducing stereotypes and addressing the social and cultural determinants of mental health, enhancing social support and involving family members in care could help improve QoL. Specifically, strengthening social support systems through community-based programs and involving families and peers in mental health care can improve QoL and life satisfaction by diminishing perceived stress or emotional distress - a positive predictor of anxiety and depression. Finally, fostering connections between older adults and community or neighborhood groups can promote social connectedness, and enhance well-being.

Conclusions

Depression, anxiety, and stress had a negative relationship with life satisfaction, while QoL had a positive relationship. QoL mediated the relationship of depression and stress with life satisfaction. This study's findings could be used in designing mental health services and programs that ultimately aim to enhance older adults' life satisfaction and quality of life. Future studies may explore factors that interplay in the mediating role of QoL in the relationship between mental health and life satisfaction. Given the global trend of nationwide longitudinal aging studies, future research has an opportunity to expand the geographical boundaries to include a nationally representative sample of older adults in Nepal. Finally, social support plays an important role in the pathway between mental health and life satisfaction. Future research should explore these pathways by including social support in the pathways.

Supplementary Information

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Supplementary Material 1

Yadav *et al. BMC Geriatrics*   (2024) 24:1025

Page 9 of 10

Declarations

Ethics approval and consent to participate
The Ethics Committee at the Nepal Health Research Council approved the study (Ref#114/2021P). Before the data collection, written informed consent was obtained from all participants, and participation was voluntary. Thumbprint impressions were obtained from participants who had no formal education (illiterate) and were approved by the ethics committee. The privacy and confidentiality of all study participants were maintained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Conflict of interest
The authors declare no conflict of interest.

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