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1 **Relationship between depression and risk of malnutrition among**  
2 **community-dwelling young-old and old-old elderly people**

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36 Journal

37 Aging & Mental Health

38

39 Abstract

40 Objectives: The present study explores the association between nutritional  
41 status and depression among healthy community-dwelling young-old (aged 65–  
42 74) and old-old elderly (aged 75 and older).

43

44 Method: A cross-sectional design was implemented. A total of 274  
45 community-dwelling older individuals (142 young-old; 132 old-old) were  
46 assessed using the Geriatric Depression Scale (GDS), Short-Form  
47 Mini-Nutritional Assessment (MNA-SF), and Life-Space Assessment (LSA).

48 Logistic regression analysis was used to determine if depression was  
49 independently associated with risk of malnutrition, stratified by age (young-old vs.  
50 old-old).

51

52 Results: In the logistic regression model for young-old, being at risk of  
53 malnutrition ( $MNA-SF \leq 11$ ) was strongly associated with depression ( $GDS \geq$   
54 5) (likelihood ratio = 6.26; 95% confidence interval [CI]: 1.91–20.49). In contrast,  
55 in the old-old group, the model was not statistically significant.

56

57 Conclusion: Depression and nutritional status were strongly correlated in  
58 young-old but not in old-old community-dwelling elderly. This study reveals that  
59 not only the factors correlated with but also the symptoms of depression may  
60 vary among different age stratifications of the elderly.

61

62 Keywords: Depression, Nutritional Status, Young-old

63

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65 **community-dwelling young-old and old-old elderly people**

66

67

68 Introduction

69 In an aging population, depression is a serious public health issue due to its  
70 societal burden and association with various factors. The total cost of depression  
71 in Japan in 2005 was estimated to be 2.0 trillion yen (USD 1 = JPY 78: October  
72 2012) (Sado et al., 2011), which includes all direct, morbidity, and mortality costs.  
73 Further, studies in a variety of settings have shown that depression is strongly  
74 associated with low function and poor quality of life, increase in the use of health  
75 services, late-life suicide tendency, and excess mortality (Callahan, Hui,  
76 Nienaber, Musick, & Tierney, 1994; Cuijpers & Smit, 2002; Geerlings, Beekman,  
77 Deeg, Twisk, & Van Tilburg, 2002; Koenig, Shelp, Goli, Cohen, & Blazer, 1989;  
78 Nyunt, Lim, Yap, & Ng, 2012; Turvey et al., 2002; Van der Weele, Gussekloo, De  
79 Waal, De Craen, & Van der Mast, 2009; Wada et al., 2005). A systematic review  
80 of 34 community-based studies reported that the prevalence of depression in the  
81 elderly is as high as 35% (Beekman, Copeland, & Prince, 1999; Woo et al.,  
82 1994). In terms of the type of depression, major depression is relatively rare and  
83 minor depression more common (Beekman, Copeland, & Prince, 1999). In

84 addition, clinicians often fail to diagnose and treat depression in the elderly, and  
85 elderly individuals are reluctant to report depressive symptoms (Georgotas,  
86 Cooper, Kim, & Hapworth, 1983; Lyness et al., 1995; Webber et al., 2005).  
87 Therefore, depression in the elderly has often been unrecognized, and it is  
88 important to clarify the components of depression to improve the sensitivity of  
89 screening methods.

90

91 Many variables, including gender, marital status, cognitive status, activities of  
92 daily living and independent activities of daily living limitations, and social  
93 engagement, are associated with increased depression (Anstey, Von Sanden,  
94 Sargent-Cox, & Luszcz, 2007; Glass, Mendes De Leon, Bassuk, & Berkman,  
95 2006). Meanwhile, weight loss and loss of appetite are the main factors that  
96 mediate the relationship between depression and nutritional status (Rubenstein,  
97 Harker, Salvà, Guigoz, & Vellas, 2001). Recently, multiple studies have indicated  
98 an association between depression and nutritional status in various settings  
99 such as outpatient clinics and institutions and in the community (Cabrera, Mesas,  
100 Garcia, & Andrade, 2007; Kaburagi et al., 2011; Smoliner et al., 2009; Wilson,  
101 Vaswani, Liu, Morley, & Miller, 1998). In these settings, depression is an  
102 independent predictor of nutritional health and a major cause of weight loss  
103 (Chen, Chang, Chyun, & McCorkle, 2005; Morley & Kraenzle, 1994; Thompson

104 & Morris, 1991). Conversely, better diet quality is beneficial for preventing and  
105 improving depressive symptoms (Akbaraly et al., 2009; Lin & Su, 2007). The  
106 relationship between depression and nutritional status is interactive and further  
107 investigation is still needed. In this regard, the aging society needs to be  
108 considered. The word 'elderly' is very broad, encompassing all individuals aged  
109 older than 60 or 65 years. Age may alter the relationship among the various  
110 variables associated with depression. For example, the young-old (age 65–74  
111 years) and old-old (age 75 years and above) have different predispositions  
112 regarding various aspects of both depression and nutritional status (Kaburagi et  
113 al., 2011; Kondo, Kazama, Suzuki, & Yamagata, 2008). Older elderly are more  
114 likely to experience frailty, physical illness, bereavement, and loneliness, which  
115 are risk factors contributing to depression (Bruce, 2002; Blazer, 2002).  
116 Investigating age-group differences may help in clarifying the correlation  
117 between depression and nutritional status and in developing precise,  
118 age-stratified interventions.

119

120 The purpose of the present study was to analyse the association between  
121 depression and nutritional status in different age groups of  
122 non-functionally-impaired, community-dwelling elderly.

123



124

## 125 Methods

### 126 [Participants]

127 Study participants were recruited through advertisements in the local press and  
128 at local healthcare events from April 2011 to June 2012. A total of 274  
129 community-dwelling older individuals volunteered in the study. The inclusion  
130 criteria were an age of 65 years or older, living in the community, and being able  
131 to walk independently with or without a cane. The exclusion criteria ensured that  
132 none of the participants had any indications of the following health problems: (a)  
133 symptomatic cardiovascular disease, (b) neurological and orthopaedic disorders,  
134 (c) peripheral neuropathy of the lower extremities, and (d) severe arthritis.

135

136 This study was approved by the Ethical Review Board of Kyoto University  
137 Graduate School of Medicine, Kyoto, Japan.

138

### 139 [Variables]

140 The following variables were collected using a questionnaire.

141

142 Depression was screened for by the 15-item Geriatric Depression Scale (GDS)  
143 (Yesavage, 1988), a validated and reliable self-report scale that detects

144 depression in elderly people. Scores range from 0 to 15. We used a cut-off of 4/5,  
145 which is a recommended indicator of depression in Japanese populations  
146 (Murata, Kondo, Hirai, Ichida, & Ojima, 2008; Yamazaki, Nakano, Saito, &  
147 Yasumura, 2012).

148

149 Nutritional status was assessed with the Short-Form Mini-Nutritional  
150 Assessment (MNA-SF) (Rubenstein et al., 2001). MNA-SF includes 6 items  
151 dealing with loss of appetite, weight loss, mobility, stress or illness, dementia or  
152 depression, and body mass index (BMI). Scores range from 0 to 14. A score of  
153 12 or above indicates satisfactory nutritional status, a score of 8 to 11 implies  
154 risk of malnutrition, and a score less than 7 suggest malnourishment.

155

156 Life-space mobility was assessed by the Life-Space Assessment (LSA) (Baker,  
157 Bodner, & Allman, 2003), a questionnaire that measures the spatial extent of  
158 individuals in a given month. The LSA takes into account the frequency of travel  
159 to different life-space levels (bedroom, driveway, within neighbourhood, outside  
160 neighbourhood but within town, and out of town), and whether personal or  
161 technical assistance was required to get to those levels. The composite scores  
162 range from 0 to 120.

163

164 [Statistical Analysis]

165 Statistical analysis was carried out with the software package SPSS 20.0 (SPSS  
166 Inc., Chicago, IL). Relationships between MNA-SF items and depression were  
167 evaluated with chi-square tests. Multivariate analysis was performed to examine  
168 the association between depression and risk of malnutrition. Step-up logistic  
169 regression analysis was used to determine if depression ( $GDS \geq 5$ ) was  
170 independently associated with risk of malnutrition ( $MNA-SF \leq 11$ ). In Model I, all  
171 of the participants were analysed. Model II contained only young-old participants,  
172 and Model III contained only old-old participants. Demographic factors (age,  
173 gender, and BMI) and LSA were adjusted in each model. An acceptable level of  
174 statistical significance was considered to be a p value of  $< .05$ .

175

176

177 Results

178 Participant characteristics are shown in Table 1. The mean age was 74.33 (SD  
179 4.72) years, and 185 participants (67.5%) were female. Classifying participants  
180 by age, 142 were young-old (51.8%) and 132 participants were old-old (48.2%).  
181 Fifty-nine participants (21.5%) were depressed. Seventy-seven (28.1%) were at  
182 risk of malnutrition (including 1 participant determined to be malnourished), and  
183 the others were well nourished. Old-old participants had a higher risk of

184 malnutrition than young-old ones, but no significant differences were found for  
185 depression. The nutritional characteristics of the participants are shown in Table  
186 2. Among the young-old, there was a trend that depressed participants were  
187 more likely to have a loss of appetite within the past 3 months than the  
188 non-depressed participants, but this difference was not statistically significant ( $p$   
189 = .075). There was no trend toward significance in the old-old group ( $p$  = .502).

190

191 In the logistic regression model for young-old (Model II), being at risk of  
192 malnutrition ( $MNA-SF \leq 11$ ) was strongly associated with depression ( $GDS \geq 5$ )  
193 (likelihood ratio = 6.74; 95% confidence interval [CI]: 2.11–21.51) independent  
194 from the control variables, while this association was not found in Models I and  
195 III (Table 3).

196

197

## 198 Discussion

199 The present study found a correlation between GDS and MNA-SF for young-old  
200 individuals, but not for old-old individuals or for the two groups combined.  
201 Multiple studies conclude that depression and malnutrition are related, but that  
202 the influence of age on the variables differs. Previous studies reported that  
203 depression is an independent predictor of malnutrition or nutritional risk even

204 after adjusting for social and educational factors in young-old elderly adults but  
205 not old-old elderly adults (Cabrera et al., 2007; Callen and Wells, 2005). These  
206 differences could arise because depressive symptoms in the elderly have  
207 different clinical features along the age spectrum from young-old to old-old  
208 (Mehta et al., 2008). For example, old-old elderly may suffer from a higher  
209 prevalence of disability or medical illnesses (Chou & Chi, 2005). Having a  
210 chronic disease is a variable that independently influences depression  
211 (Schoevers et al., 2000). The relationship between depression and malnutrition  
212 needs to be further examined, with physical, mental, and social status taken into  
213 consideration.

214

215 Various studies have reported a positive relationship between depression and  
216 nutritional status, and they often associate depression with loss of appetite or  
217 weight loss (Akbaraly et al., 2009; Davison & Kaplan, 2012). However, the rates  
218 of depressed participants in the present study with loss of appetite or weight loss  
219 were 13.6% and 30.5% in the young-old and old-old, respectively, and were  
220 relatively low. Only the relationship between depression and loss of appetite in  
221 young-old elderly showed a trend toward significance, and other relationships  
222 (between depression and weight loss in young-old and between depression and  
223 loss of appetite or weight loss in old-old) did not. Callen and Wells (2005)

224 reported that in old-old elderly, depression is not a predictor of weight loss or low  
225 BMI when adjusting for social, physical, and economic factors, a finding which is  
226 in agreement with our results. The relationship between depression and loss of  
227 appetite may have been the principal reason behind the result obtained in the  
228 present multivariate analysis, that is, the positive relationship between  
229 depression and malnutrition.

230

231 Our study has several limitations. The cross-sectional design prevents us from  
232 making causal inferences. We also did not assess socioeconomic and  
233 educational status and social support; the possibility of these being confounding  
234 factors cannot be denied. Despite these limitations, this study reveals that the  
235 factors correlated with depression could vary among different age groups of  
236 elderly and suggests that depression and nutritional status are correlated more  
237 strongly in young-old than old-old elderly. Future studies should focus on  
238 clarifying the causal relationship, consider the age of subjects and assess  
239 nutritional status, social status, etc., for better understanding of depression.

240

241 Reference

242 Akbaraly, T.N., Brunner, E.J., Ferrie, J.E., Marmot, M.G., Kivimaki, M., &  
243 Singh-Manoux, A. (2009). Dietary pattern and depressive symptoms in middle

244 age. *British Journal of Psychiatry*, 195, 408-413

245

246 Anstey, K.J., Von Sanden, C., Sargent-Cox, K., & Luszcz, M.A. (2007).

247 Prevalence and risk factors for depression in a longitudinal, population-based

248 study including individuals in the community and residential care. *American*

249 *Journal of Geriatric Psychiatry*, 15, 497-505

250

251 Baker, P.S., Bodner, E.V., & Allman, R.M. (2003). Measuring Life-Space Mobility

252 in Community-Dwelling Older Adults. *Journal of the American Geriatrics Society*,

253 51, 1610-1614

254

255 Beekman, A.T.F., Copeland, J.R.M., & Prince, M.J. (1999). Review of community

256 prevalence of depression in later life. *British Journal of Psychiatry*, 174, 307-311

257

258 Bruce, M.L. (2002). Psychosocial risk factors for depressive disorders in late life.

259 *Biological Psychiatry*, 52, 175-184

260

261 Blazer, DG. (2002). *Depression in Later Life*. New York: Springer.

262

263 Cabrera, M.A.S., Mesas, A.E., Garcia, A.R.L., & de Andrade, S.M. (2007).

264 Malnutrition and Depression among Community-dwelling Elderly People.  
265 *Journal of the American Medical Directors Association, 8, 582-584*  
266

267 Callahan, C.M., Hui, S.L., Nienaber, N.A., Musick, B.S., & Tierney, W.M. (1994).  
268 Longitudinal study of depression and health services use among elderly primary  
269 care patients. *Journal of the American Geriatrics Society, 48, 833-838*  
270

271 Callen, B.L. & Wells, T.J. (2005). Screening for nutritional risk in  
272 community-dwelling old-old. *Public Health Nursing, 22, 138-146*  
273

274 Chen, C.C.-H., Chang, C.-K., Chyun, D.A., & McCorkle, R. (2005). Dynamics of  
275 nutritional health in a community sample of American elders: A multidimensional  
276 approach using Roy Adaptation Model. *Advances in Nursing Science, 28,*  
277 *376-389*  
278

279 Chou, K.-L. & Chi, I. (2007). Prevalence and correlates of depression in Chinese  
280 oldest-old. *International Journal of Geriatric Psychiatry, 20, 41-50*  
281

282 Cuijpers, P. & Smit, F. (2002). Excess mortality in depression: A meta-analysis of  
283 community studies. *Journal of Affective Disorders, 72, 227-236.*



284

285 Davison, K.M. & Kaplan, B.J. (2012). Food intake and blood cholesterol levels of  
286 community-based adults with mood disorders. *BMC Psychiatry*. Retrieved from  
287 <http://dx.doi.org/10.1186/1471-244X-12-10>

288

289 Geerlings, S.W., Beekman, A.T., Deeg, D.J., Twisk, J.W., & Van Tilburg, W.  
290 (2002). Duration and severity of depression predict mortality in older adults in the  
291 community. *Psychological Medicine*, 32, 609-618.

292

293 Georgotas, A., Cooper, T., Kim, M., & Hapworth, W. (1983). The treatment of  
294 affective disorders in the elderly. *Psychopharmacology Bulletin*, 19, 226-237

295

296 Glass, T.A., Mendes De Leon, C.F., Bassuk, S.S., & Berkman, L.F. (2006). Social  
297 engagement and depressive symptoms in late life: Longitudinal findings. *Journal*  
298 *of Aging and Health*, 18, 604-628

299

300 Kaburagi, T., Hirasawa, R., Yoshino, H., Odaka, Y., Satomi, M., Nakano, M., ...,  
301 Sato, K. (2011). Nutritional status is strongly correlated with grip strength and  
302 depression in community-living elderly Japanese. *Public Health Nutrition*, 14,  
303 1893-1899

304

305 Koenig, H.G., Shelp, F., Goli, V., Cohen, H.J., & Blazer, D.G. (1989). Survival  
306 and health care utilization in elderly medical inpatients with major depression.  
307 *Journal of the American Geriatrics Society*, 37, 599-606.

308

309 Kondo, N., Kazama, M., Suzuki, K., & Yamagata, Z. (2008). Impact of mental  
310 health on daily living activities of Japanese elderly. *Preventive Medicine*, 46,  
311 457-462

312

313 Lin, P.-Y. & Su, K.-P. (2007). A meta-analytic review of double-blind,  
314 placebo-controlled trials of antidepressant efficacy of omega-3 fatty acids.  
315 *Journal of Clinical Psychiatry*, 68, 1056-1061

316

317 Lyness, J.M., Cox, C., Curry, J., Conwell, Y., King, D.A., & Caine, E.D. (1995).  
318 Older age and the underreporting of depressive symptoms. *Journal of the*  
319 *American Geriatrics Society*, 43, 216-221

320

321 Mehta, M., Whyte, E., Lenze, E., Hardy, S., Roumani, Y., Subashan, ...,  
322 Studenski, S. (2008). Depressive symptoms in late life: Associations with apathy,  
323 resilience and disability vary between young-old and old-old. *International*

324 *Journal of Geriatric Psychiatry, 23, 238-243*

325

326 Morley, J.E. & Kraenzle, D. (1994). Causes of weight loss in a community  
327 nursing home. *Journal of the American Geriatrics Society, 42, 583-585*

328

329 Murata, C., Kondo, K., Hirai, H., Ichida, Y., & Ojima, T. (2008). Association  
330 between depression and socio-economic status among community-dwelling  
331 elderly in Japan: The Aichi Gerontological Evaluation Study (AGES). *Health and*  
332 *Place, 14, 406-414*

333

334 Nyunt, M.S., Lim, M.L., Yap, K.B., & Ng, T.P. (2012). Changes in depressive  
335 symptoms and functional disability among community-dwelling depressive older  
336 adults. *International Psychogeriatrics* (Epub ahead of print). Retrieved from  
337 <http://dx.doi.org/10.1017/S1041610212000890>

338

339 Rubenstein, L.Z., Harker, J.O., Salvà, A., Guigoz, Y., & Vellas, B. (2001).  
340 Screening for undernutrition in geriatric practice: Developing the Short-Form  
341 Mini-Nutritional Assessment (MNA-SF). *Journals of Gerontology - Series A*  
342 *Biological Sciences and Medical Sciences, 56, M366-M372*

343

344 Sado, M., Yamauchi, K., Kawakami, N., Ono, Y., Furukawa, T.A., Tsuchiya, M.,  
345 ..., Kashima, H. (2011). Cost of depression among adults in Japan in 2005.  
346 *Psychiatry and Clinical Neurosciences*, 65, 442-450.

347

348 Schoevers, R.A., Beekman, A.T.F., Deeg, D.J.H., Geerlings, M.I., Jonker, C., &  
349 Van Tilburg, W. (2000). Risk factors for depression in later life; results of a  
350 prospective community based study (AMSTEL). *Journal of Affective Disorders*,  
351 59, 127-137

352

353 Smoliner, C., Norman, K., Wagner, K.-H., Hartig, W., Lochs, H., & Pirlich, M.  
354 (2009). Malnutrition and depression in the institutionalised elderly. *Current*  
355 *Opinion in Clinical Nutrition and Metabolic Care*, 11, 1-6

356

357 Thompson, M.P. & Morris, L.K. (1991). Unexplained weight loss in the  
358 ambulatory elderly. *Journal of the American Geriatrics Society*, 39, 497-500

359

360 Turvey, C.L., Conwell, Y., Jones, M.P., Phillips, C., Simonsick, E., Pearson, J.L.,  
361 & Wallace R. (2002). Risk factors for late-life suicide: A prospective,  
362 community-based study. *American Journal of Geriatric Psychiatry*, 10, 398-406.

363

364 Van der Weele, G.M., Gussekloo, J., De Waal, M.W.M., De Craen, A.J.M., & Van  
365 der Mast, R.C. (2009). Co-occurrence of depression and anxiety in elderly  
366 subjects aged 90 years and its relationship with functional status, quality of life  
367 and mortality. *International Journal of Geriatric Psychiatry*, 24, 595-601  
368

369 Wada, T., Ishine, M., Sakagami, T., Kita, T., Okumiya, K., Mizuno, K., ...,  
370 Matsubayashi, K. (2005). Depression, activities of daily living, and quality of life  
371 of community-dwelling elderly in three Asian countries: Indonesia, Vietnam, and  
372 Japan. *Archives of Gerontology and Geriatrics*, 41, 271-280.  
373

374 Webber, A.P., Martin, J.L., Harker, J.O., Josephson, K.R., Rubenstein, L.Z., &  
375 Alessi, C.A. (2005). Depression in older patients admitted for postacute nursing  
376 home rehabilitation. *Journal of the American Geriatrics Society*, 53, 1017-1022  
377

378 Wilson, M.-M.G., Vaswani, S., Liu, D., Morley, J.E., & Miller, D.K. (1998).  
379 Prevalence and causes of undernutrition in medical outpatients. *American*  
380 *Journal of Medicine*, 104, 56-63  
381

382 Woo, J., Ho, S.C., Lau, J., Yuen, Y.K., Chiu, H., Lee, H.C., & Chi, I. (1994). The  
383 prevalence of depressive symptoms and predisposing factors in an elderly

384 Chinese population. *Acta Psychiatrica Scandinavica*, 89, 8-13

385

386 Yamazaki, S., Nakano, K., Saito, E., & Yasumura, S. (2012). Prediction of

387 functional disability by depressive state among community-dwelling elderly in

388 Japan: A prospective cohort study. *Geriatrics and Gerontology International*.

389 Article in Press.

390

391 Yesavage, J.A. (1988). Geriatric Depression Scale. *Psychopharmacology*

392 *bulletin*, 24, 709–711.

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394

Table 1. Participant characteristics according to age

	All participants		Young-old		Old-old		p value
	(n = 274)		(age 65–75; n = 142)		(age ≥ 75; n = 132)		
	mean	SD	mean	SD	mean	SD	
Age (years)	74.33	4.72	70.61	2.33	78.34	3.07	< .001
Female, %	67.5		66.2		68.9		.699
BMI	22.44	3.26	22.65	3.21	22.23	3.31	.287
LSA (range, 0–120)	87.83	21.08	89.91	20.62	85.59	21.41	.107
MNA-SF score (range, 0–14)	12.32	1.56	12.44	1.50	12.20	1.61	.253
At risk of malnutrition, % (MNA-SF score ≤ 11)†	28.1		21.8		34.8		.022
GDS score (range, 0–15)	2.71	2.74	2.55	2.70	2.89	2.78	.228
Depression, % (GDS score ≥ 5)	21.5		19.7		23.5		.466

BMI: body mass index; LSA: Life-Space Assessment; MNA-SF: Short-Form Mini-Nutrition Assessment; GDS: Geriatric

Depression Scale

† Includes one participant classified as malnourished in the young-old group

p values determined by Mann-Whitney U test or chi-square test

395

396

Table 2. Nutritional characteristics, measured by MNA-SF, of young-old and old-old participants with and without depression

	With depression (GDS $\geq$ 5)				Without depression (GDS < 5)				p value
	n (%)				n (%)				
MNA-SF items (ranking)†	0	1	2	3	0	1	2	3	
Young-old (n = 142)									
Loss of appetite	1 (3.6)	3 (10.7)	24 (85.7)	-	0 (0)	5 (4.4)	109 (95.6)	-	.075
Weight loss	0 (0)	3 (10.7)	6 (21.4)	19 (67.9)	0 (0)	6 (5.3)	13 (11.4)	95(83.3)	.108
Mobility	0 (0)	-	28 (100)	-	0 (0)	-	114 (100)	-	-
Stress or acute illness	6 (21.4)	-	22 (78.6)	-	7 (6.1)	-	107 (93.9)	-	.022*
Neuropsychological status	2 (7.1)	1 (3.6)	25 (89.3)	-	0 (0)	0 (0)	114 (100)	-	.007**
Body mass index	4 (14.3)	6 (21.4)	7 (25.0)	11 (39.3)	11 (9.6)	16 (14.0)	45 (39.5)	42 (36.8)	1.000
Old-old (n = 132)									



Loss of appetite	0 (0)	4 (12.9)	27 (87.1)	-	0 (0)	9 (8.9)	92 (91.1)	-	.597
Weight loss	0 (0)	3 (9.7)	6 (19.4)	22 (71.0)	3 (3.0)	6 (5.9)	12 (11.9)	80 (79.2)	.398
Mobility	0 (0)	-	31 (100)	-	0 (0)	-	101 (100)	-	.399
Stress or acute illness	6 (19.4)	-	25 (80.6)	-	8 (7.9)	-	93 (92.1)	-	.076
Neuropsychological status	1 (3.2)	1 (3.2)	29 (93.5)	-	0 (0)	2 (2.0)	99 (98.0)	-	.261
Body mass index	3 (9.7)	8 (25.8)	6 (19.4)	14 (40.6)	17 (16.8)	21 (20.8)	22 (21.8)	41 (40.6)	.681

MNA-SF: Short-Form Mini-Nutrition Assessment; GDS: Geriatric Depression Scale

† Higher scores indicate better function

Chi-square test: Loss of appetite and neuropsychological status, 0–1 vs. 2; weight loss and body mass index, 0–2 vs. 3; stress or acute

illness, 0 vs. 2

\*  $p < .05$ , \*\*  $p < .01$

Table 3. Step-up logistic regression model of variables associated with depression (GDS  $\geq 5$ )

	All participants (Model I) (n = 274)		Young-old (Model II) (age 65–75; n = 142)		Old-old (Model III) (age $\geq 75$ ; n = 132)	
	Likelihood ratio (95% CI)	p value	Likelihood ratio (95% CI)	p value	Likelihood ratio (95% CI)	p value
Risk of malnutrition (MNA-SF $\leq 11$ )	-	NS	6.738** (2.111–21.510)	.001	-	NS
Age (years)	-	NS	-	NS	-	NS
Gender (male 0; female 1)	-	NS	-	NS	-	NS
BMI	-	NS	1.201* (1.033–1.395)	.017	-	NS
LSA	.985* (.971– .999)	.031	-	NS	-	NS

GDS: Geriatric Depression Scale; MNA-SF: Short-Form Mini-Nutrition Assessment; BMI Body Mass Index; LSA: Life-Space Assessment

NS: not selected

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\* p < .05, \*\* p < .01

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