

Interactive Effect of Lifestyle, Sleep Quality and Depressive Symptoms: A Questionnaire Study of Retired Workers in A Medium-sized City of Northeastern China

Shi-Chen Zhang

¹*Department of Maternal and Child Health
Anhui Medical University
Anhui, China*

²*East Asian Health Promotion Network Center (EAHP-net)
Kumamoto, Japan
zhangshichen@ahmu.edu.cn*

Li-jun Yu

*Department of Internal Medicine
Enterprise Hospital of Liaoning Power Plant
Liaoning, China*

14235434@qq.com

Jun Wang

*Department of Internal Medicine
Enterprise Hospital of Liaoning Power Plant
Liaoning, China*

1730846167@qq.com

Atsushi Ueda

¹*East Asian Health Promotion Network Center (EAHP-net)
Kumamoto, Japan*

²*Department of Preventive and Environmental Medicine,
Graduate School of Medical Sciences,
Kumamoto University
Japan
a-ueda@gpo.kumamoto-u.ac.jp*

Chang-nian Wei

¹*East Asian Health Promotion Network Center (EAHP-net)
Kumamoto, Japan*

²*Department of Preventive and Environmental Medicine,
Graduate School of Medical Sciences,
Kumamoto University
Japan
cnwei@gpo.kumamoto-u.ac.jp*

Jun Fang*

¹*Department of Toxicology, School of Public Health
Anhui Medical University
Hefei, Anhui Province, P.R, China*

²*Faculty of Pharmaceutical Science, Sojo University
Kumamoto, Japan
fangjun@ph.sojo-u.ac.jp*

Abstract—Lifestyle is an important determinant factor for mental diseases. This cross-sectional study aimed to examine the independent and interactive association between lifestyle and sleep quality with depressive symptoms in Chinese retired workers. One thousand two hundred and sixty-eight retired workers (aged 60 - 94 yrs) in China were recruited in this study. The outcomes were self-reported depressive symptoms, sleep quality, lifestyle and demographic variables. The detection rate of depressive symptoms and sleep disorder was 30.8% and 38.5%. Unhealthy lifestyle was significantly associated with depressive symptoms ($OR = 9.801, 95\% CI: 6.357 - 15.112$). Sleep disorder was significantly positively correlated with depressive symptoms ($OR = 1.280, 95\% CI: 1.003 - 1.632$). Unhealthy lifestyle and sleep disorder were independently and interactively associated with increased risks of depressive symptoms. These findings suggest that unhealthy lifestyle and sleep disorder are potentially suffering from depressive symptoms in Chinese retired workers. Intervention programs should enhance lifestyle and improve sleep quality.

Keywords—depressive symptoms, sleep quality, lifestyle, workers

I. INTRODUCTION

In the past few decades, the importance of a healthy lifestyle has attracted more and more attention on a global scale. Ample research supports the important role of lifestyle in human health, and it is becoming more and more clear that healthy lifestyle can improve health conditions and well-being,

and reduce poor health outcome. In contrast, unhealthy lifestyle will result in chronic diseases even those having negative psychological effects, such as diabetes mellitus, cancer, cardiovascular disease, depression, and anxiety [1-3]. Consequently, encouraging the healthy lifestyle is crucial which could potentially prevent the development of chronic diseases, reduce morbidity, improve quality of life (QOL), medical costs, and decrease the health care burden.

Depression is a leading cause of disability and a major contributor to the burden of disease. Globally, more than 350 million people of all ages suffer from depressive disorders [4]. Approximately 15% to 20% of older adults have significant depressive symptoms [5]. The cause of depression is multifactorial, including environmental, psychological, genetic, hormonal, immunological, biochemical and neurodegenerative factors, etc [6-7]. While many of these factors are immutable, some are open to modification and could provide the basis of practical interventions for the management of depression. Specifically, lifestyle factors play a role in the etiology of depression [1,3,8].

A sleep disorder is serious enough to interfere with normal physical, mental, social and emotional functioning [9]. Sleeping disorder is wide spread, with the prevalence of 56%, 31% and 23% in USA, Western Europe and Japan, respectively [10]. Around one-third of adults experience the symptoms of insomnia, and approximately 6% meet the diagnosis of insomnia worldwide [11]. In China, 9.2% - 32.9% of adults are suffering from sleeping disorder, with higher rates in women

This study was partly supported by Grants for Scientific Research of BSKY (No. XJ201113) from Anhui Medical University, partly by the School Foundation from Anhui Medical University (No. 2013xkj007), and partly by the National Natural Science Foundation of China (81402699).

patients, and especially older adults [12-14]. Previous researches have shown sleep problems, such as sleep disturbance and chronic insomnia, elevated risk of mental disorders [15-16]. Chronic insomnia can induce functional impairment as well as increase the risk of severe conditions such as depression and cardiovascular disease in the long term [17-18], resulting in impaired quality of life. In addition, a significant connection was found among elderly people between insomnia and mental disorders, such as depression and/or anxiety [19].

Lifestyle is a more useful predictor for an individual's health status than income, employment status, and education level [20-21]. Many studies have shown that healthy lifestyle is an important determinant factor for preventing physical and promoting mental diseases, particularly for those with major depression, leading to improved QOL [1, 22]. In this context, the aim of this study was to examine (i) associations of lifestyle and sleep quality with depressive symptoms; (ii) the interactive effects of lifestyle and sleep quality on depressive symptoms in Chinese retired workers.

II. MATERIALS AND METHODS

A. Data Collection and Sampling

The present study is a cross-sectional survey study, with 1268 retired workers (aged 60 - 94 yrs) recruited from the Retired Workers Activity Center of a power plant in Fushun City, Liaoning Province, China. This power plant is located in the rural-urban fringe in eastern of Fushun City, and it provides annual physical examination and some social welfare for retired workers instead of local community [22]. The participants could read and write Chinese, to whom a self-reporting questionnaire was distributed from July to October in 2013.

B. Design of Questionnaires

A self-report questionnaire was used to collect information on demographic variables, lifestyle, sleep quality, and depressive symptoms during 30 min. Demographic characteristics include age, gender, educational level, marriage status, and income.

The Health Promoting Lifestyle Profile II (HPLP-II) has been extensively used to measure and evaluate lifestyles or daily activity [23]. The Chinese version of HPLP-II was used to evaluate the retired workers' lifestyle in this study. The reliability and validity of this HPLP-II have been demonstrated in previous studies [21,24]. The overall score of HPLP-II was calculated from the mean score of 52 items. Each participant was asked to rate each item according to a Likert response scale as follows: 1= never, 2 = sometimes, 3 = often, and 4 = routinely. Retired workers in this study were categorized as low, medium and high lifestyle when their scores were $< P_{25}$, $P_{25} - P_{75}$ and $> P_{75}$ respectively. In this study, the Cronbach's α coefficient for the HPLP-II was 0.930.

The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. This questionnaire encompasses components of subjective quality, habitual efficiency, latency,

disorders, medication use, duration, and diurnal dysfunctions. Each component was evaluated on a scale of 0 to 3 points and given the same value, with three points marking the negative end of the scale. The sum of the values constitutes the total PSQI index; scores were equal or greater than 8 would indicate sleep disturbance in the present study [25]. In this study, the Cronbach's α coefficient for the PSQI was 0.730.

The Geriatric Depression Scale (GDS) was developed by Yesavage *et al.* [26], and Liu *et al.* tested the validity and reliability of the Chinese version [27]. The self-reported scale consists of 30 items and requires yes/no responses to the questions. Higher scores represent higher levels of depressive symptoms. A summary score ranged from 0 to 30 was generated, and a cut-off of more than 11 was used to define the presence of depressive symptoms. In this study, the Cronbach's α coefficient for the GDS was 0.802.

C. Statistical Analysis

Statistical analysis was performed using SPSS ver. 23.0 for Windows (SPSS, Inc., Chicago, IL). The Chi-square analysis of variance was performed to assess differences in the characteristics for categorical variables, and effect sizes were calculated. The logistic regression analysis was performed to examine the relationships between lifestyle, sleep quality and depressive symptoms. Analyses were adjusted to control for key demographic and socioeconomic variables. Statistical significance was set at $P < 0.05$.

III. RESULTS

A. Univariate Analysis

Participants had a mean age of 69 years ($P_{25} = 63$, $P_{75} = 74$), and the overall HPLP-II mean score for all participants was 2.99 ± 0.44 , and the value of P_{25} and P_{75} were 2.72, 3.31, respectively. The scores were normally distributed and the variability in the data was homogeneous. Overall, about 54.9% of respondents were male, 52.1% were 60 - 70 years, 46.5% were under high school degree, 50.6% were middle income, and 86.9% were married. 63.6%, 30.8% and 38.5% of the retired workers had chronic disease, depressive symptoms and sleep disorder, respectively.

As shown in Table I, the detection rates of depressive symptoms were presented by frequency characteristics. The total rate of depressive symptoms revealed statistically significant differences by chronic disease [no (18.6%) vs. yes (37.7%), $P < 0.001$], and the same tendency was shown on age group, educational level, marriage status, chronic disease, income, and smoking ($P < 0.05$ for each), while depressive symptoms revealed no statistically significant differences by gender. Moreover, there was a marked difference between lifestyle [low scores (54.1%) vs. medium scores (29.5%) vs. high scores (10.7%), $V = 0.322$] and sleep disorder [no (28.7%) vs. yes (34.0%), $\phi = 0.056$] with depressive symptoms ($P < 0.05$ for each, Table I).

TABLE I. FREQUENCY CHARACTERISTICS OF THE SAMPLE IN THE CURRENT STUDY

Variable	Total Sample (n= 1268)	Depressive symptoms		χ^2	ϕ/V
		No (n= 878)	Yes (n= 390)		
Gender				0.551	0.021
Male	696 (54.9)	488 (70.1)	208 (29.9)		
Female	572 (45.1)	390 (68.2)	182 (31.8)		
Age group (years)				8.205 *	0.080 *
60~	660 (52.1)	468 (70.9)	192 (29.1)		
70~	544 (42.9)	358 (65.8)	186 (34.2)		
80~	64 (5.0)	52 (81.3)	12 (18.8)		
Educational level				7.557 **	-0.077 **
< High school degree	590 (46.5)	386 (65.4)	204 (34.6)		
≥ High school degree	678 (53.5)	492 (72.6)	186 (27.4)		
Marriage status				5.452 *	-0.066 *
Single	166 (13.1)	102 (61.4)	64 (38.6)		
Married	1102 (86.9)	776 (70.4)	326 (29.6)		
Chronic disease				50.317 ***	0.199 ***
No	462 (36.4)	376 (81.4)	86 (18.6)		
Yes	806 (63.6)	502 (62.3)	304 (37.7)		
Income				8.223 *	0.081 *
Low (below ¥ 2000)	250 (19.7)	158 (63.2)	92 (36.8)		
Middle (¥ 2001- ¥ 3000)	642 (50.6)	442 (68.8)	200 (31.2)		
High (¥ 3001 or above)	376 (29.7)	278 (73.9)	98 (26.1)		
Smoking				12.864 **	0.101 **
Never smoke	960 (75.7)	688 (71.7)	272 (28.3)		
1-10 tobaccos/day	202 (15.9)	130 (64.8)	72 (35.6)		
≥11 tobaccos/day	106 (8.4)	60 (56.6)	46 (43.4)		
Sleep disorder				3.957 *	0.056 *
No	780 (61.5)	556 (71.3)	224 (28.7)		
Yes	488 (38.5)	322 (66.0)	166 (34.0)		
Overall				131.350 ***	0.322 ***
Low	292 (23.0)	134 (45.9)	158 (54.1)		
Medium	678 (53.5)	478 (70.5)	200 (29.5)		
High	298 (23.5)	266 (89.3)	32 (10.7)		

^a Note. Statistical methods: Chi-square test, ϕ/V is effect sizes. Values are presented as number (percentage) when appropriate. Overall is the mean score of all 52 items of the Health Promoting Lifestyle Profile II. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

B. Multiple Logistic Regression Analysis

Results from multiple logistic regression analysis showed that, low and medium scores of lifestyle were significantly associated with depressive symptoms ($OR = 9.801$, 95% CI : 6.357 - 15.112; and $OR = 3.478$, 95% CI : 2.326 - 5.200; $P < 0.001$ for each). Meanwhile, sleep disorder was significantly positively correlated with depressive symptoms ($OR = 1.280$, 95% CI : 1.003-1.632; $P < 0.05$). After adjusting for gender, age, marriage status, educational level, income, chronic disease, smoking, the associations were also significant (Table II).

As shown in Table III, the interaction effects of lifestyle and sleep disorder with depressive symptoms, and the crude and adjusted OR (95% CI), were presented for each group in comparison with the reference group (no sleep disorder and high scores of lifestyle) for depressive symptoms, respectively. A significant additive interaction was observed between lifestyle and sleep disorder ($P < 0.001$). In particular, the retired workers with low scores of lifestyle and sleep disorder had the highest risks of depressive symptoms ($OR = 32.679$, 95% CI : 14.047 - 76.024; $P < 0.001$). Further, these associations were also seen in the adjusted models (Table III).

TABLE II. ASSOCIATIONS OF LIFESTYLE, SLEEP DISORDER AND DEPRESSIVE SYMPTOMS AMONG RETIRED WORKERS

	Depressive symptoms (Crude)			Depressive symptoms (Adjusted ^a)		
	β	Wald	OR (95% CI)	β	Wald	OR (95% CI)
Lifestyle						
High	-	-	Ref.	-	-	Ref.
Medium	1.246	36.903	3.478 (2.326 - 5.200) ***	1.142	29.535	3.134 (2.076 - 4.732) ***
Low	2.283	106.757	9.801 (6.357 - 15.112) ***	2.200	90.047	9.028 (5.731 - 14.223) ***
Sleep disorder						
No	-	-	Ref.	-	-	Ref.
Yes	0.247	3.949	1.280 (1.003 - 1.632) *	0.272	4.409	1.313 (1.018 - 1.693) *

^b Note. ^a Adjusted for gender, age, marriage status, educational level, income, chronic disease, smoking. * $P < 0.05$, *** $P < 0.001$ compared with referent.

TABLE III. ODDS RATIO (95% CI) ASSOCIATED WITH THE LIFESTYLE AND SLEEP DISORDER ON DEPRESSIVE SYMPTOMS AMONG RETIRED WORKERS

Sleep disorder	Lifestyle	Depressive symptoms (Crude)			Depressive symptoms (Adjusted ^a)			P [*]
		β	Wald	OR (95%CI)	β	Wald	OR (95%CI)	
No	High	-	-	Ref.	-	-	Ref.	< 0.001
	Medium	0.933	4.786	2.542 (1.102 - 5.862) *	0.977	5.090	2.655 (1.137 - 6.202) *	
	Low	1.702	20.022	5.486 (2.603 - 11.564) ***	1.656	18.425	5.236 (2.459 - 11.151) ***	
Yes	High	2.121	29.576	8.337 (3.882 - 17.903) ***	2.066	27.296	7.895 (3.637 - 17.138) ***	
	Medium	2.646	45.813	14.099 (6.553 - 30.336) ***	2.678	44.281	14.549 (6.612 - 32.013) ***	
	Low	3.487	65.510	32.679 (14.047 - 76.024) ***	3.402	58.824	30.009 (12.582 - 71.576) ***	

^c Note. ^a Adjusted for age, marriage status, educational level, income, chronic disease, smoking, drinking. * $P < 0.05$, *** $P < 0.001$ compared with referent. ^{*} P -value of interaction between lifestyle and sleep disorder on depressive symptoms in multiplicative model.

IV. DISCUSSION

These findings of the present study suggest that lifestyle and sleep quality are independently and interactively associated with depressive symptoms. Namely, unhealthy lifestyle and sleep disorder are correlated with an increased detection rates of depressive symptoms.

Depression in elderly people occurs frequently. In the current study, we found a detection rates of 30.8% of depressive symptoms in the subjected population, which is higher than previous study for Chinese older adults in Taiwan and Hong Kong [1,28]. The possible reason may be that survey methods and definition are different, and also the differences in the sample and cultural background may also influence the result. Although some studies suggest that women are more likely to have depressive symptoms than men in America [29], our present study did not find significant difference for depressive symptoms between men and women. It thus may be equally important to promote the Chinese older adults' mental health both in male and female.

Increasing evidence is suggesting that lifestyle as a key factor is associated with depressive and well-being [30-31]. Epidemiological studies consistently suggest that physical inactivity maybe a risk factor for the development of depressive symptoms [32-33]. Moreover, fewer incidences of depressive symptoms were reported in older adults with healthy dietary pattern which was also related to self-rated health [27-28,34]. In the current study, a significant association of lifestyle with depression symptoms was observed, indicating that unhealthy lifestyle may remarkably increase the incidence of depressive symptoms. Moreover, unhealthy lifestyle and sleep disorder increase the risk of depressive symptoms independently and synergistically, in Chinese older adults.

However, it should be also noted that there are some limitations in the present study. First, the reliance on self-report nature of the data, and recall and reporting biases could not be avoided. Moreover, because this study used a cross-sectional design, the results do not imply causality but suggest the possible association of lifestyle and sleep quality with older adults' mental health. Longitudinal studies may be thus needed to clarify causal relationship of lifestyle and sleep quality with depressive symptoms in the future study.

V. CONCLUSIONS

Taken together, the present study demonstrates the associations of lifestyle and sleep quality with depressive

symptoms in Chinese retired workers, indicating that unhealthy lifestyle is significantly positively correlated with mental health. Furthermore, unhealthy lifestyle and sleep disorder are associated with increased risks of depressive symptoms. Further research is needed to clarify the potential mechanisms underlying this relationship. These findings suggest that the intervention program for older adults should focus on improving healthy lifestyle and sleeping disorders, thus attenuating the severity of depressive symptoms, and maintaining desirable healthy status and well-being.

ACKNOWLEDGEMENTS

The authors gratefully thank the staff of the Retired Workers Activity Center of the Liaoning power plant for their cooperation on-site during the process of data acquisition. We especially thank the East Asian Health Promotion Network Center (EAHP-net) for their support. This study was partly supported by Grants for Scientific Research of BSKY (No. XJ201113) from Anhui Medical University, partly by the School Foundation from Anhui Medical University (No. 2013xkj007), and partly by the National Natural Science Foundation of China (81402699).

ETHICAL CONSIDERATIONS

This study was conducted after obtaining informed consent from all subjects in written form and approval from the Ethics Committee of Anhui Medical University (approval number 20131197), and this study was performed in accordance with the Declaration of Helsinki.

REFERENCES

- [1] A.C.Tsai, S.H. Chi, J.Y. Wang, "Cross-sectional and longitudinal associations of lifestyle factors with depressive symptoms in ≥ 53 -year old Taiwanese- results of an 8-year cohort study," *Prev. Med.*, 57, 92-97, 2013.
- [2] S. Nechuta, W.Y. Chen, H. Cai, E.M. Poole, M.L. Kwan, S.W. Flatt, R.E. Patterson, J.P. Pierce, B.J. Caan, X.O. Shu, "A pooled analysis of post-diagnosis lifestyle factors in association with late estrogen-receptor positive breast cancer prognosis," *Int. J. Cancer*, 138, 2088-2097, 2016.
- [3] P.D. Freitas, P.G. Ferreira, A. da Silva, S. Trecco, R. Stelmach, A. Cukier, R. Carvalho-Pinto, J.M. Salge, F. Fernandes, M.C. Mancini, M.A. Martins, C.R. Carvalho, "The effects of exercise training in a weight loss lifestyle intervention on asthma control, quality of life and psychosocial symptoms in adult obese asthmatics: protocol of a randomized controlled trial," *BMC. Pulm. Med.*, 15, 124, 2015.
- [4] World Health Organization, "Depression," Fact sheet No. 369. <http://www.who.int/mediacentre/factsheets/fs369/en/> (accessed on May. 15, 2018).

- [5] J.J. Gallo, B.D. Lebowitz, "The epidemiology of common late-life mental disorders in the community: themes for the new century," *Psychiatr. Serv*, 50, 1158-1166, 1999.
- [6] R.H. Belmaker, G. Agam, "Major depressive disorder," *N. Engl. J. Med.*, 358, 55-68, 2008.
- [7] M. Maes, Z. Fišar, M. Medina, G. Scapagnini, G. Nowak, M. Berk, "New drug targets in depression: inflammatory, cell-mediated immune, oxidative and nitrosative stress, mitochondrial, antioxidant, and neuroprogressive pathways. And new drug candidates-Nrf2 activators and GSK-3 inhibitors," *Inflammopharmacology*, 20, 127-150, 2012.
- [8] F.N. Jacka, A. Mykletun, M. Berk, "Moving towards a population health approach to the primary prevention of common mental disorders," *BMC Med*, 10, 149, 2012.
- [9] A.G. Harvey, N. Dagsy, "Sleep disorders in adults. In P. Sturmey & M. Hersen (Eds.), *Handbook of evidence-based practice in clinical psychology*, Vol. II: Adult disorders," Hoboken, NJ: Wiley, 2012.
- [10] D. Leger, B. Poursain, D. Neubauer, M. Uchiyama, "An international survey of sleeping problems in the general population," *Curr. Med. Res. Opin*, 24, 307-317, 2008.
- [11] M.M. Ohayon, "Epidemiology of insomnia: what we know and what we still need to learn. *Sleep*," *Med. Rev.*, 6, 97-111, 2002.
- [12] Y.T. Xiang, X. Ma, Z.J. Cai, S.R. Li, Y.Q. Xiang, H.L. Guo, Y.Z. Hou, Z.B. Li, Z.J. Li, Y.F. Tao, W.M. Dang, X.M. Wu, J. Deng, K.Y. Lai, G.S. Ungvari, "The prevalence of insomnia, its sociodemographic and clinical correlates, and treatment in rural and urban regions of Beijing, China: a general population-based survey," *Sleep*, 31, 1655-1662, 2008.
- [13] X. Liu, L. Liu, "Sleep habits and insomnia in a sample of elderly persons in China," *Sleep*, 28, 1579-1587, 2005.
- [14] J. Wu, G. L. Xu, Y. Shen, L. Zhang, S. Song, H. Yang, Y. Liang, T. Wu, Y. Wang, "Daily sleep duration and risk of metabolic syndrome among middle-aged and older Chinese adults: cross-sectional evidence from the Dongfeng-Tongji cohort study," *BMC Public Health*, 15, 178, 2015.
- [15] C.L. Drake, V. Pillai, T. Roth, "Stress and sleep reactivity: a prospective investigation of the stress-diathesis model of insomnia," *Sleep*, 37, 1295-1304, 2013.
- [16] D.A. Kalmbach, V. Pillai, P. Cheng, J.T. Arnedt, C.L. Drake, "Shift work disorder, depression, and anxiety in the transition to rotating shifts: the role of sleep reactivity," *Sleep Med*, 16, 1532-1538, 2015.
- [17] C. Baglioni, G. Battagliese, B. Feige, K. Spiegelhalder, C. Nissen, U. Voderholzer, C. Lombardo, D. Riemann, "Insomnia as a predictor of depression: a meta-analytic evaluation of longitudinal," *J. Affect. Disord*, 135, 10-19, 2011.
- [18] F. Sofi, F. Cesari, A. Casini, C. Macchi, R. Abbate, G.F. Gensini, "Insomnia and risk of cardiovascular disease: a meta-analysis," *Eur. J. Prev. Cardiol*, 21, 57-64, 2014.
- [19] J.X. Zhang, X.H. Liu, X.H. Xie, D. Zhao, M.S. Shan, X.L. Zhang, X.M. Kong, H. Cui, "Mindfulness-based stress reduction for chronic insomnia in adults older than 75 years: a randomized, controlled, single-blind clinical trial," *Explore (NY)*, 11, 180-185, 2015.
- [20] C.K. Wong, C.S. Fung, C.S. Siu, K.W. Wong, Y.Y. Lo, Y.Y. Fong, C.L. Lam, "The impact of work nature, lifestyle, and obesity on health-related quality of life in Chinese professional drivers," *J. Occup. Environ. Med*, 54, 989-994, 2012.
- [21] S.C. Zhang, F.B. Tao, A. Ueda, C.N. Wei, J. Fang, "The influence of health-promoting lifestyles on the quality of life of retired workers in medium-sized city of Northeastern China," *Environ. Health Prev. Med*, 18, 458-465, 2013.
- [22] S.C. Zhang, C.N. Wei, K. Harada, K. Ueda, K. Fukumoto, H. Matsuo, K. Minamoto, T. Nishikawa, E. Araki, A. Ueda, J. Fang, "Relationship between lifestyle and lifestyle-related factors in a rural-urban population of Japan," *Environ. Health Prev. Med*, 18, 267-274, 2013.
- [23] S. Walker, K. Sechrist, N. Pender, "The health-promoting lifestyle profile: development and psychometric characteristics," *Nurs. Res*, 36, 76-81, 1987.
- [24] Y.J. Wang, L.J. Wu, W. Xia, C.H. Sun, C.N. Wei, A. Ueda, "Reliability and Validity of Chinese Version of the Health-Promoting Lifestyle Profile," *Chin. J. Sch. Health*, 28, 889-891, 2007. [In Chinese with English abstract].
- [25] D.J. Buysse, C.F. Reynolds, T.H. Monk, S.R. Berman, D.J. Kupfer, "The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research," *Psychiatry Res*, 28, 193-213, 1989.
- [26] J.A. Yesavage, T.L. Brink, T.L. Rose, O. Lum, V. Huang, M. Adey, V.O. Leirer, "Development and validation of a geriatric depression screening scale: a preliminary report," *J. Psychiatr. Res*, 17, 37-49, 1982-1983.
- [27] J. Liu, Y. Wang, X.H. Wang, R.H. Song, X.H. Yi, "Reliability and validity of the Chinese Version of Geriatric Depression Scale among Chinese urban community-dwelling elderly population," *Chin. J. Clin. Psycho*, 21, 39-41, 2013. [In Chinese with English abstract].
- [28] R. Chan, D. Chan, J. Woo, "A prospective cohort study to examine the association between dietary patterns and depressive symptoms in older Chinese people in Hong Kong," *PLoS. One*, 9, e105760, 2014.
- [29] P.O. Chocano-Bedoya, E.J. O'Reilly, M. Lucas, F. Mirzaei, O.I. Okereke, T.T. Fung, F.B. Hu, A. Ascherio, "Prospective study on long-term dietary patterns and incident depression in middle-aged and older women," *Am. J. Clin. Nutr*, 98, 813-820, 2013.
- [30] M. Berk, J. Sarris, C.E. Coulson, F.N. Jacka, "Lifestyle management of unipolar depression," *Acta Psychiatr. Scand. Suppl*, 443, 38-54, 2013.
- [31] M.J. Serrano Ripoll, B. Oliván-Blázquez, E. Vicens-Pons, M. Roca, M. Gili, A. Leiva, J. García-Campayo, M.P. Demarzo, M. García-Toro, "Lifestyle change recommendations in major depression: Do they work?" *J. Affect. Disord*, 183, 221-228, 2015.
- [32] R.A. Mekary, M. Lucas, A. Pan, O.I. Okereke, W.C. Willett, F.B. Hu, E.L. Ding, "Isotemporal substitution analysis for physical activity, television watching, and risk of depression," *Am. J. Epidemiol*, 178, 474-483, 2013.
- [33] M. Chang, J. Snaedal, B. Einarsson, S. Björnsson, J.S. Saczynski, T. Aspelund, M. Garcia, V. Gudnason, T.B. Harris, L.J. Launer, P.V. Jonsson, "The association between midlife physical activity and depressive symptoms in late life: age gene/ environment susceptibility-Reykjavik Study," *J. Gerontol. A Biol. Sci. Med. Sci*, 71, 502-507, 2016.
- [34] L. Gougeon, H. Payette, J. Morais, P. Gaudreau, B. Shatenstein, K. Gray-Donald, "Dietary patterns and incidence of depression in a cohort of community-dwelling older Canadians," *J. Nutr. Health. Aging*, 19, 431-436, 2015.