Archives of Gerontology and Geriatrics 83 (2019) 20–27

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Characteristics of centenarians' lifestyles and their contribution to life satisfaction: A case study conducted on Hainan Island

Zhe Hao[a,b,d], Lihong Chen[a], Yonghua Li[c,*], Xinqing Zou[b,d,e,**], Hairong Li[c], Ziyue Feng[b,d], Xuyu Bai[b], Zhifu Wang[a], Jian Qian[a], Yuefeng Xu[c]

[a] Key Laboratory of Engineering Oceanography, Second Institute of Oceanography, Ministry of Natural Resources, Hangzhou, 310012, China
[b] School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing, 210093, China
[c] Key Laboratory of Land Surface Pattern and Simulation, Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, 100101, China
[d] Collaborative Innovation Center of South China Sea Studies, Nanjing University, Nanjing, 210093, China
[e] Key Laboratory of Coast and Island Development (Nanjing University), Ministry of Education, Nanjing, 210093, China

ARTICLE INFO

Keywords:
Centenarian
Common characteristics
Life satisfaction
Sex differences
Sleep satisfaction

ABSTRACT

Background: Centenarians represent an intriguing model for healthy aging. They appear to have adapted well to their lives and are likely to be influenced by previous lifestyle habits, and their life satisfaction is influenced by mental and psychological health.
Objective: The aim of this study is to explore centenarians' lifestyles by sex and their potential contribution to life satisfaction.
Method: In order to examine the common characteristics of centenarians in Hainan and the potential differences between men and women, a cross-sectional survey was conducted with 223 cognitively-intact Chinese centenarians. We also explored the association between life satisfaction and other physical factors using binary logistic regression and principal component analysis.
Results: The results provided supplementary evidence indicating that women tended to live longer than men. However, the difference in life satisfaction observed between the sexes was not obvious ($p = 0.659$). The proportion of physical factors between each sex showed a similar trend in distribution. Most centenarians' lifestyles were similar, in that they followed a light diet and did not smoke or drink alcohol. Centenarians in better physical condition and with higher self-assessment, as well as those with "alcohol and tobacco habits," were more satisfied with their life. Of the factors examined in the binary logistic regression, sleep satisfaction was the only factor significantly positively correlated with life satisfaction ($p < .01$).
Conclusion: The research findings elucidated physiological and psychological health in centenarians and provided a model of healthy aging strategies for reference purposes.

1. Introduction

Aging populations (i.e., aged 60 years and older) have been growing in size and proportion around the globe and are of increasing interest to researchers. In the meantime, the phenomenon of extreme longevity has been increasing, and the number of centenarians has increased dramatically (Passarino, De Rango, & Montesanto, 2016). According to the World Population Prospects published by the United Nations, the number of centenarians per 100,000 people increased from 3.25 in 2005 to 5.87 in 2015, and the number continues to rise. This worldwide aging trend has increasingly drawn greater attention from scientists and the public to the centenarian group in terms of their health condition and lifestyle. Within aging populations, centenarians represent an intriguing model for studies that examine aging, as they represent extreme longevity and successful aging (Ozaki, Uchiyama, Tagaya, Ohida, & Ogihara, 2007) because of their healthy dispositions and the maintenance of healthy lifestyles (Franchini & Mannucci, 2007; Ozaki et al., 2007; Perls, Levenson, Regan, & Puca, 2002). Successful aging is defined by Rowe and Kahn's (1998) model and includes the following five indicators: "no major diseases," "no disability," "high cognitive functioning," "high physical functioning" and "active engagement with life." Successful aging has been a goal in the field of gerontology for a

* Corresponding author.
** Corresponding author at: School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing, 210093, China.
E-mail addresses: yhli@igsnrr.ac.cn (Y. Li), zouxq@nju.edu.cn (X. Zou).

https://doi.org/10.1016/j.archger.2019.03.022
Received 6 November 2018; Received in revised form 14 March 2019; Accepted 25 March 2019
Available online 26 March 2019

long time and is of great interest to researchers in the field of public health (Liu et al., 2017; McLaughlin, Connell, Heeringa, Li, & Roberts, 2010).

In the past, scientific questions regarding longevity have primarily been examined from a broad perspective and involved environmental influences. However, with the increasing importance of human perception, researchers have begun to focus on centenarians and other longevity groups from a relatively narrow perspective. These studies prompt us to pay more attention to the centenarian group.

1.1. Lifestyle characteristics

Many studies have focused on centenarians in estimating the prevalence of super longevity in communities and explaining related influential factors (Christensen & Vaupel, 1996; Robine & Paccaud, 2005; Wilkinson & Sainsbury, 1998). Previous studies have shown that longevity is influenced by genetic, environmental, physiological, psychological, socioeconomic, and natural factors (Christensen & Vaupel, 1996; Darviri et al., 2008; Forte et al., 2014; Gonos, 2000; Hao, Liu et al., 2016; Lv et al., 2011; Magnolfi et al., 2009; Martin, Poon, Kim, & Johnson, 1996). Several studies have endeavored to analyze the genetic and environmental factors influencing longevity; however, sociological factors and lifestyle should not be ignored in centenarians. Earlier experiences and their long-term consequences in terms of adjustment and functioning in later life have resulted in a common lifestyle (Martin, Deshpande-Kamat, Poon, & Johnson, 2011).

Diet is one of the most important lifestyle factors, and the maintenance of a controlled and balanced diet with adequate nutrition has been identified as the most effective means of decelerating the aging process (Perls et al., 2002; Pes et al., 2013). Most centenarians were moderate or small eaters, and more than half reported healthy eating habits such as that of following a regular diet (Hao, Liu et al., 2016; Li et al., 2014; Rajpathak et al., 2011). A nutritious diet, adequate physical exercise, and a harmonious family environment were identified as key lifestyle factors affecting longevity in centenarians in Chongqing (Li et al., 2014).

Drinking alcohol and smoking are widely recognized health risks (Aguilera et al., 2008) that reduce the likelihood of living a long, healthy life. Smoking has also been identified as a factor reducing life expectancy (Basavaraj, 1993; Cicconetti et al., 2002). Cigarette smoking has been closely associated with the most common causes of death in elderly people and contributes to the high mortality rate in men (Bratzler, Oehlert, & Austelle, 2002; Tafaro et al., 2007). Furthermore, alcohol consumption can have an adverse effect on vital organs, which causes deterioration of the human body, leading to chronic diseases (Mukamal, Robbins, Cauley, Kern, & Siscovick, 2007).

Psychosocial factors such as personality are also important longevity factors. Centenarians may share common personality profiles that enhance their prospects for longevity (Masui, Gondo, Inagaki, & Hirose, 2006). Healthy lifestyle factors, such as sufficient sleep and positive mental health, have also been observed in centenarians (Cicconetti et al., 2002; Wang et al., 2016). A survey of the common lifestyle characteristics of centenarians can help elucidate their successful life pattern for future reference.

1.2. QOL and life satisfaction

Longevity is often considered a symbol of health and happiness, but the factors that contribute to healthy old age are complex. An increasing number of studies have examined the centenarian group to explore their successful aging. Previous research involving either centenarians or longevity focused on environmental factors and the contribution of beneficial elements. Quality of life (QOL) and life satisfaction warrant more attention because they are important indexes that reflect centenarians' state of living. QOL involves the nonspecific perception of all aspects of an individuals' existence (Horley, 1984) and constitutes a dimension of mental health (Benham, 2010; Headey, Kelley, & Wearing, 1993). Life satisfaction is often defined as a subjective judgement of one's current life situation in relation to one's expectations (Jacobsson, Westerberg, & Lexell, 2010). It refers to one's ongoing evaluation of the conditions of life as a whole, which presumably requires cognitive processing.

In addition, life satisfaction provides a comprehensive reflection of spiritual and material life and demonstrates the extent of individuals' QOL. Previous interviews with centenarians have indicated that they had adapted well to their lives, maintained positive attitudes, and experienced high levels of satisfaction with life and social and family relationships (Dello Buono, Urciuoli, & De Leo, 1998). Happiness, life satisfaction, and well-being are interrelated concepts regarding one's quality of life, and they can have interaction effects. Moreover, life satisfaction has been identified as an important index of mental health in elderly people in many studies and included as a social variable in gerontology research (Larson, 1978; Willits & Crider, 1988). It is meaningful to identify the key factors affecting life satisfaction of centenarians.

A growing body of literature uses physical and mental health or well-being-related measures as indicators for social integration (Malmusi, 2015; Sardadvar, 2015). Well-being is a complex construct that concerns optimal experience and functioning (Richard & Edward, 2001), while life satisfaction can be more easily quantified, In a previous study, subjective health and activities of daily living (ADL) were the important factors for life satisfaction, and centenarians reported high levels of well-being and were found to be happy (Jopp, Park, Lehrfeld, & Paggi, 2016). Life satisfaction can be enhanced through interventions to improve factors such as self-rated health, regular physical examinations, and mental health (Wang et al., 2018). ADL constituted the most common factor used to evaluate QOL (Araujo, Ribeiro, & Paul, 2017; MacDonald, Martin, Margrett, Poon, & Georgia Centenarian, 2009). However, the factors that influence centenarians' life satisfaction require examination. Researchers tend to examine positive and negative effects via mediation models of life satisfaction and have shown that cognition is likely to be a key determinant of life satisfaction (Bishop, Martin, Poon, & Johnson, 2011; Bishop, Martin, Randall, MacDonald, & Poon, 2012); however, the examination of cognition was nonspecific. People become more satisfied not simply because they live better but also because they are more positive and feel better (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009). Surveying centenarians' lifestyles and their life satisfaction helps summarize their patterns and possible reasons for their successful aging. Analyzing and identifying the determinants of life satisfaction can help provide rational suggestions for improving the state of life for the elderly.

1.3. Sex differences

Historically, women have lived longer than men in almost every country in the world (Steven, 2006), as reflected by disproportionately high mortality rates in men (Ginter & Simko, 2013; Luy & Gast, 2014).Thus, there were more female centenarians than male (Li et al., 2014). Furthermore, the centenarian population in general is increasing, with the number of women increasing more rapidly relative to the number of men.

Sex differences in global dimensions of self-descriptions and self-evaluations (e.g., life satisfaction) are equivocal. Although researchers have reached consensus regarding the difference in distribution between the sexes, the question as to whether aging patterns and the lifestyles of centenarians differ significantly in terms of sex should also be addressed. For older adults, sex as a variable shows differences in physical frailty and life conditions that likely have consequences for psychological functioning (Smith & Baltes, 1998). Although females in old age have the longevity advantage, they might also have sex-associated disadvantages, such as a higher rate of being widowed, poor physical health, and low socioeconomic status. Another group of

theories suggests that several sex differences may be found in psychological functioning in old age (Jopp et al., 2016). In contrast, men and women may not differ in subjective well-being (SWB) and self-concept because they may have different sources of these aspects (Pinquart & Sorensen, 2001).

Although there are many studies on sex differences in old age, studies focusing on the differences in centenarians are inadequate. Centenarians constitute an important study population because a certain number of them have managed to escape major chronic diseases and enjoy relatively satisfactory levels of autonomy (Dello Buono et al., 1998; Samuelsso et al., 1997). For people who have already reached 100 years of age, the potential differences in lifestyle or life satisfaction caused by sex should receive greater emphasis.

Therefore, the main objectives of the study were as follows: 1) description of characteristics of centenarians in Hainan, 2) exploration of potential differences in characteristics between sexes, 3) and identification of the factors that have a significant influence on satisfaction. The research findings supplement the study of health and longevity and can help explain the common physiological and psychological conditions of centenarians so that their lifestyle habits can be adopted by others to improve longevity. This study quantifies psychological indexes to analyzethe interconnectedness between life satisfaction and lifestyle factors. It can provide evidence regarding whether sex is a determinant of centenarians' lifestyle or life satisfaction and which factors play an important role in life satisfaction. Since Hainan is a proxy for regions with exceptionally high levels of human longevity, studying its residents can provide complementary research on healthy aging and centenarians' life satisfaction. The results will also provide entry-points for policy on developing healthy aging strategies and add to the findings of prior gerontological studies.

2. Methods

2.1. Study setting

Hainan Island was chosen as the study setting because it has the highest proportion of centenarians in China. Indeed, it is famous for its residents' longevity and was recognized by the International Expert Committee on Population Aging and Longevity as a "World Longevity Island" on August 27, 2014 (Hao et al., 2016) According to the demographic database of the sixth Chinese census, 1162 centenarians reside on Hainan Island, and the proportion of centenarians per 100,000 people is 13.40 (China NBS), with both values ranking highest in China (Hao, Li et al., 2016). The number of centenarians in Hainan increased by 250% within 10 years, from 2000 to 2010 (Chinese demographic database of the fifth census, 2000; Chinese demographic database of the sixth census, 2010). In addition, most centenarians are native to the island and unlikely to have migrated or lived outside the region during their lifetimes, and they also share similar lifestyles.

2.2. Sample and data collection

Population data were collected from the demographic database for the sixth national Chinese census (Chinese demographic database of the sixth census, 2010) and the World Population Prospects (2017). We administered 223 questionnaires to "relatively healthy centenarians" to explore the characteristics of longevity. "Relatively healthy centenarians" were defined based on a modified version of the criteria developed by Darviri et al. (Darviri et al., 2008; Hao, Li et al., 2016). The research team applied the following exclusion criteria to ensure that the study sample would consist of relatively healthy and functional centenarians: (1) the respondents should be able to adequately communicate with the interviewer and grant an interview of their own volition; (2) they should not be bed-ridden; (3) they should be relatively functional (i.e. be able to move in and out of their houses and be self-served); (4) residence at his/her current address for at least 10 years. No proxy interviews occurred, and no institutionalized centenarians were included in the sample. All study participants were informed about the study objectives and agreed to participate.

Centenarian samples were selected from all 18 administrative divisions in the Hainan province in 2013. The survey team tried to interview all centenarians who voluntarily agreed to participate. Since centenarians were a sensitive and specific population, we obtained their information with the help of the Bureau of Civil Affairs (BCA) because they have all necessary information about the local population as a population department. Before the investigation, we communicated with the staff about the function of the questionnaire. The proportion of centenarians from each county varied (Hao, Liu et al., 2016). In order to increase efficiency and minimize distractions to centenarians, 223 centenarians were preselected based on the register from the BCA, with consideration to physical condition and regional distribution. The BCA staff conducted preselection to filter out those who did not meet the required criteria. Therefore, the effective response rate in this study was 100%. The city and county distribution of the participants was as even as possible to cover the broadest physical area and allow for representativeness. The questionnaires were completed via face-to-face interviews. Help from participants' caregivers and the staff of the Bureau of Civil Affairs was needed occasionally for translation because of language or expression differences. A survey for younger people was conducted in December 2018 for comparison, and 50 questionnaires were collected in total.

2.3. Measures

All questionnaires were distributed evenly between administrative divisions. The questionnaire was designed by the researchers based on the Short Form-36 Health Survey manual and interpretation guide. Taking into consideration that the main research question of this study was to examine common characteristics of centenarians and their effect on life satisfaction, the questionnaire was designed to cover a range of topics including: (a) basic information, (b) lifestyle, (c) activity restriction, and (d) self-assessment cognition.

(a) Basic information included sex and age (based on the age of the centenarians, we divided them into three groups: 100–103, 104–107, and 108–112).
(b) Lifestyle of centenarians included smoking, alcohol consumption, and dietary habits. Participants responded "Yes" or "No" to the checklist on smoking and drinking habits. Dietary habit included foods that were light (ate food with a light taste that is not obvious salty, spicy, or oily), slightly salty, slightly spicy, and sweet in terms of taste. The choices depended on their own eating experiences and feeling, and the options were based on Chinese traditional dietary habits and descriptions for food flavors;
(c) Activity restriction was classified as severe restriction (cannot manage activity without help most of time), moderate restriction (can manage the activity but need help sometimes), and without restriction (can manage all activity without help) for daily activity including self-cooking, getting dressed/undressed, walking up/down the stairs, and taking bath unassisted (Li et al., 2011).
(d) Self-assessment cognition was indicated by self-care ability, physical health, sleep satisfaction, and life satisfaction. The options were classified into four levels (an even number) to prevent the participants from choosing the middle option without thinking. "Very Good" and "Good" indicate relatively "good health condition" or "high satisfaction," wherein "very" indicates the degree. It means the centenarians' assessment was positive, and in their opinion, they were in a relatively good condition. On the other side, "Very Bad" and "Bad" indicate negative cognition.

2.4. Statistical analysis

A crossover analysis was performed to examine the differences in participants' lifestyle habits and physical health according to sex. Life satisfaction was selected to evaluate centenarians' QOL. Scores were summarized to create a cumulative score, with higher scores indicating better health and longevity in general cognition. Lifestyle habits and physical health were included as classification variables. Binary logistic regression was performed to obtain the most reliable estimates of the associations between life satisfaction and other physical health factors. Life satisfaction was selected as the dependent variable, and the remaining factors (lifestyle, activity restriction, and self-assessment cognition) were included as independent variables because of their potential impact. We introduced dummy variables to replace the categorical variables with numerical values. The model contained only two options for each factor (1 = satisfaction; 0 = dissatisfaction). The options for activity restriction were as follows: "severe restriction" and "moderate restriction" were represented by 0, and "no restriction" was represented by 1. For the remaining factors, "very bad" and "bad" were represented by 0, and "high" and "very high" were represented by 1.Histograms were used as a visual means of displaying the distribution of centenarians according to sex, lifestyle, and health status and were created in Microsoft Excel for this study. Examination of the factors influencing life satisfaction was performed using t-test, crossover analysis, principal component analysis (PCA), and binary logistic regression using SPSS 16.0 for Windows (IBM, Chicago, IL, USA).

3. Results

3.1. Centenarians' common characteristics

The basic descriptive characteristics of centenarians in Hainan are shown in Table 1. In Hainan Province, most of the centenarians were younger than 107 years, and the oldest individual was aged 112 years. The average age of all participating centenarians was 103.20 years (males: 102.80 years; females: 103.30 years). The proportion of women in the centenarian age group was 79.82%, while that of men was 20.18%. Since it is rare to live to the age of 100, only 5.8% live with their partners and 4.5% live alone, while the remaining 89.7% live with their offspring. In this study, 73.45% of the centenarians ate light, plain food daily, which was similar to the results of the younger people, 76% of whom ate light, plain food daily. In addition, the percentage of nonsmokers was 91.93% and that of nondrinkers was 79.37% for centenarians, which is higher than 72% nonsmokers and 64% nondrinkers for the younger people surveyed. Centenarians, therefore, share a healthier lifestyle.

We also considered centenarians' physical health, and the results in Table 1 showed that approximately 32% experienced severe activity restriction, 27% experienced no activity restriction and were able to perform activities and work independently, and 41% experienced moderate activity restriction and could perform activities with assistance from others. The self-assessment results showed that more than 60% of the centenarians considered their health status (i.e., self-care ability, physical health, sleep satisfaction, and life satisfaction) good or very good, a result matching that of the younger people surveyed. Only 6.73% reported very bad self-care ability and life satisfaction, much lower than the result of 20% of younger people. In addition, while the proportion of participants who reported very bad sleep satisfaction was 21.52%, this was much higher relative to the proportion of participants who reported very bad self-care ability, physical health, and life satisfaction. As a comparison, for younger people in Hainan, the proportion of participants who reported very bad sleep satisfaction was 6%. Therefore, younger people enjoy better sleep conditions. Moreover, the proportion of centenarians who reported bad or very bad physical health was 60%, which was much higher relative to the proportion of participants who reported low levels for the other three indices. This showed that centenarians experience similarly good life conditions overall to those of younger people.

Table 1
Basic descriptive characteristics of centenarians in Hainan.

	Both sexes N (%)	Male N (%)	Female N (%)	p
Number	223(100)	45(20.18)	178(79.82)	
Age				.273
100–103	143(64.13)	34(75.56)	109(61.24)	
104–107	59(26.46)	9(20.00)	50(28.09)	
108–112	21(9.42)	2(4.44)	19(10.67)	
Average age (s.d)	103.20(2.89)	102.80(2.24)	103.30(3.07)	
Dietary habits				.515
Light	171(73.54)	35(77.78)	129(72.47)	
Slightly salty	44(18.83)	5(11.11)	37(20.79)	
Slightly spicy	9(4.04)	3(6.67)	6(3.37)	
Sweet	23(9.87)	3(6.67)	19(10.67)	
Smoking				< .001
Yes	18(8.07)	10(22.22)	8(4.49)	
No	205(91.93)	35(77.78)	170(95.51)	
Alcohol consumption				.006
Yes	46(20.63)	16(35.56)	30(16.85)	
No	177(79.37)	29(64.44)	148(83.15)	
Activity restriction				.043
Severe restriction	71(31.84)	8(17.78)	63(35.39)	
Moderate restriction	92(41.26)	25(55.56)	67(37.64)	
No restriction	60(26.91)	12(26.67)	48(26.97)	
Self-care ability				.754
Very bad	15(6.73)	3(6.67)	12(6.74)	
Bad	40(17.94)	6(13.33)	34(19.10)	
Good	86(38.57)	20(44.44)	66(37.08)	
Very good	82(36.77)	16(35.56)	66(37.08)	
Physical health				.004
Very bad	29(13.00)	3(6.67)	26(14.61)	
Bad	110(49.33)	22(48.89)	88(49.44)	
Good	77(34.53)	15(33.33)	62(34.83)	
Very good	7(3.14)	5(11.11)	2(1.12)	
Sleep satisfaction				.039
Very bad	48(21.52)	8(17.78)	40(22.47)	
Bad	19(8.52)	4(8.89)	15(8.43)	
Good	124(55.61)	20(44.44)	104(58.43)	
Very good	32(14.35)	13(28.89)	19(10.67)	
Life satisfaction				.659
Very bad	15(6.73)	2(4.44)	13(7.30)	
Bad	34(15.25)	7(15.56)	27(15.17)	
Good	131(58.74)	25(55.56)	106(59.55)	
Very good	43(19.28)	11(24.44)	32(17.98)	

3.2. Differences in characteristics based on sex

The centenarians were divided into three age groups. The comparison of the proportions of participants in each age group between sexes is shown in Table 1. For each group of men and women, the denominators were the total number of all the selected centenarians. In all age groups, the proportions of women were significantly higher relative to those of men ($p < .05$). The size of these proportions decreased as age increased. The p value of the chi-square test results from the crossover analysis showed significant differences in smoking, alcohol consumption, activity restriction, physical health, and sleep satisfaction between men and women. However, the effects of sex on self-care ability and life satisfaction were nonsignificant.

3.3. Factors influencing life satisfaction in centenarians

The coded scores and descriptive statistics for the factors influencing life satisfaction are shown in Table 2. Centenarians exhibited positive perceptions of their physical and mental health, and their mean life satisfaction score was 2.91 overall, indicating that centenarians in Hainan enjoy high levels of life satisfaction.

In order to understand the influence of a specific factor for life

Table 2
Descriptive statistics for the factors and mean value of life satisfaction (N = 223).

Variable	Coded Scores	Mean	Standard deviation	Mean value of life satisfaction	p
Smoking	Yes = 1	1.92	0.27	3.11	.245
	No = 2			2.89	
Consuming alcohol	Yes = 1	1.79	0.41	3.00	.359
	No = 2			2.88	
Activity restriction	Severe restriction = 1	1.95	0.77	2.82	.472
	Moderate restriction = 2			2.97	
	No restriction = 3			2.92	
Self-care ability	Very bad = 1	3.05	0.9	2.20	< .001
	Bad = 2			2.70	
	Good = 3			2.91	
	Very good = 4			3.13	
Physical health	Very bad = 1	2.28	0.73	2.21	< .001
	Bad = 2			2.91	
	Good = 3			3.17	
	Very good = 4			2.86	
Sleep satisfaction	Very bad = 1	2.63	0.78	2.21	< .001
	Bad = 2			2.32	
	Good = 3			3.02	
	Very good = 4			3.84	
Life satisfaction	Very bad = 1	2.91	0.9	/	
	Bad = 2				
	Good = 3				
	Very good = 4				

satisfaction, mean values of life satisfaction for all categories and all factors were also listed. Smoking and drinking alcohol are typically considered bad for one's health (Aguilera et al., 2008; Cicconetti et al., 2002; Mukamal et al., 2007). However, in this study, the higher the value of these habits, the lower the satisfaction. Since the high scores for smoking and alcohol habits were as a result of not having these defined unhealthy habits, the result showed that people with smoking and alcohol habits were more likely to be satisfied with life. On the other hand, mean values for life satisfaction showed an approximately increasing trend along with coded scores for physical condition and self-assessment.

The relationships among the selected variables for life satisfaction were complex. According to Table 2, there may be both negative and positive correlations with other variables. In order to avoid this kind of limitation, PCA was used for synthesizing numerous indexes, information overlapping of the sample, and reducing the input dimension. After rotations, two main factors were obtained instead of these six variables. The first one was defined as the "Life condition" factor (which represents the variables of Activity restriction, Self-care ability, Physical health, and Sleep satisfaction), and the second one was termed as the "Alcohol and tobacco habits" (which represents the variables of Smoking and alcohol consumption) (Table 3).

Correlations and regression were also used to examine the relationship between life satisfaction and these two factors. In this result, shown in Table 4, "Life conditions" had a significant positive effect on life satisfaction ($p < .01$), while "Alcohol and tobacco habit" was inversely correlated. The result supplements that in Table 2.

Table 3
Component matrix of PCA.

Variables	Component	
	1	2
1. Smoking	−.251	.748
2. Consuming alcohol	−.225	.738
3. Activity restriction	.667	.384
4. Self-care ability	.817	−.133
5. Physical health	.769	−.085
6. Sleep satisfaction	.539	−.143

Table 4
Coefficients resulting from regression.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.E	Beta		
Constant	2.906	.047		61.638	.000
Life condition	.336	.047	.431	7.112	.000
Alcohol and tobacco habits	−.064	.047	−.083	−1.363	.174

Table 5
Results of the binary logistic regression analysis.

Variable	B	SE	Wald	df	p	Exp (B)
Smoking	−.099	.858	.013	1	.908	.906
Drinking alcohol	.027	.549	.002	1	.960	1.028
Activity restriction	−.610	.538	1.286	1	.257	.543
Self-care ability	.665	.511	1.690	1	.194	1.944
Physical health	−.756	1.242	.370	1	.543	.470
Sleep satisfaction	2.999	.432	48.226	1	< .001	20.057
Constant	−.278	.823	.114	1	.736	.757

SE = standard error.

Binary logistic regression was performed to obtain the most reliable estimates of the associations between life satisfaction and other physical health factors. Life satisfaction was chosen as the dependent variable, while other factors were independent variables. The results of the binary logistic regression analysis are summarized in Table 5. Sleep satisfaction was the only factor that was significantly and positively correlated with life satisfaction.

4. Discussion

One of the objectives of the current study was to clarify centenarians' common characteristics in Hainan. The proportion of women in the centenarian age group was four times that of men, showing that women tend to live longer than men. Our result showed similar trends in the distribution of centenarians by sex as those displayed in other locations (Li et al., 2014). A higher death rate among men compared that among women has resulted in a highly unbalanced sex composition. Overall, the centenarians of Hainan generally partake in a light diet. In addition, most centenarians in this study were nonsmokers and nondrinkers. These results indicated that their healthy lifestyles contributed to their longevity.

The second aim of the study was to explore potential differences in characteristics between sexes. The asymmetry of the evolutionary processes of the two sexes could lead to differences in lifestyle and the ways in which men and women age (He et al., 2016). The results of our study indicated significant differences in numerous health-related factors according to sex. However, this may be due to the much higher number of women than men. When examining distribution proportion instead of raw numbers in each sex group, similar trends were observed. The proportions of nonsmokers and nondrinkers were significantly higher relative to those of smokers and drinkers for both sexes, and the proportion of men who smoked and drank alcohol was significantly higher relative to the proportion of women. This finding was consistent with those in previous studies, in which smoking and drinking habits differed significantly between centenarian men and women (Berg et al., 2008; Du et al., 2011; Felson, Zhang, Hannan, Kannel, & Kiel, 1995; Hoidrup et al., 1999; Mukamal et al., 2007). In those studies, the

number of centenarian men who smoked was significantly higher than the number of centenarian women (Li et al., 2014; Tafaro et al., 2004). Similar trends in distribution proportion of physical health were observed in both sexes. When ignoring the impact of the proportion of gender distribution, no obvious differences were observed between men and women. These results indicated that although women were likely to live longer and constituted a higher proportion among the centenarians, they shared a similar lifestyle and physical health with men in the centenarian group. This is consistent with previous studies in which no evidence of differences in aging patterns was observed between sexes in centenarians (He et al., 2016).

The most meaningful part of this study was confirming what factors had an influence on life satisfaction. Our results suggested although smoking and drinking were considered to be closely associated with the most common causes of death that contribute to a high mortality rate (Bratzler et al., 2002; Tafaro et al., 2007), these habits appeared to contribute to centenarians' life satisfaction, which could be the reason that centenarians maintain these unhealthy habits. This indicates that centenarians with satisfactory "Life conditions" as well as "Alcohol and tobacco habits" were more likely to be satisfied with life. Moreover, "Life conditions" was the main factor.

The result of binary logistic regression analysis indicated that centenarians who reported high levels of sleep satisfaction also expressed greater satisfaction with life. Therefore, sleep satisfaction was the most important factor influencing life satisfaction. Sleep-related problems are known to increase with age (Bastos Leite, Scheltens, & Barkhof, 2004; Jirong, Changquan, Hongmei, & Bi-Rong, 2013; Plassman et al., 2007). High-quality of sleep in very old adults could have implications for the achievement of healthy longevity (Gu, Sautter, Pipkin, & Zeng, 2010), while poor sleep quality was negatively associated with good health(Yan, Chang-Quan, Zhen-Chan, & Bi-Rong, 2012). In previous studies, sleep disturbance has been associated with numerous diseases (Cho, 2015; Furihata et al., 2012; Gu et al., 2010; Hale et al., 2013; Milojevich & Lukowski, 2016; Ross, Yang, Klagholz, Wehrlen, & Bevans, 2016; Taira et al., 2002), which could reduce their satisfaction with life. In one study, between-group comparisons showed that poor sleepers reported significantly lower satisfaction with life relative to that reported by people who slept well (Benham, 2010). Similar to those involving other elderly people, studies involving centenarians have demonstrated positive correlations between sleep quality, survival, and successful aging (Tafaro et al., 2007).

5. Limitations

This study had several limitations. For example, the complex correlation between physical and mental factors may cause cross-effects that impact the conclusions drawn from these results. Differences in the centenarians' cognitive abilities may also have an impact and, therefore, be a limitation for this study.

6. Conclusions

In the current study, we administered 223 questionnaires to healthy centenarians in Hainan province. Their characteristics, including lifestyle habits and physical health, were identified as the key factors affecting longevity. Most of the centenarians were younger than 107 years of age, and the oldest participant was 112 years of age. In addition, the majority of participants followed a light diet and did not smoke or drink alcohol. Approximately one-third of the centenarians experienced severe activity restriction, while the remaining participants reported moderate or no activity restriction. More than 60% of the centenarians considered their health status (i.e., self-care ability, physical health, sleep satisfaction, and life satisfaction) good or very good. The number of women in the centenarian age group was significantly higher relative to that of men, indicating that women tended to live longer relative to men. The findings provided supplementary evidence on centenarians' common characteristics which may provide suggestions to the general public regarding lifestyle for longevity and successful aging. When ignoring the impact of the considerable differences between sexes, no obvious differences in participants' characteristics were observed in terms of sex. They shared a similar lifestyle and physical health; as a result, their level of life satisfaction had little difference. This supports the argument that sex difference in centenarians was less obvious than in other age groups, especially for life satisfaction. Better "Life conditions" contributed to centenarians' life satisfaction. Although alcohol and tobacco habits are regarded as harmful to health, it was shown that centenarians with these habits were more likely to be satisfied with life. This seems to contradict the findings of previous studies that drinking and smoking are harmful to health. In fact, this conclusion indicates that for centenarians, health status is not the key factor affecting their life satisfaction. The result also suggests that among the factors examined, including lifestyle (smoking and drinking habits), activity restriction, and self-assessment cognition (self-care ability, physical health, and sleep satisfaction), sleep satisfaction was significantly and positively correlated with life satisfaction; therefore, it could be considered the most important factor affecting centenarians' satisfaction with life and could contribute to their longevity. These findings provide evidence for centenarians' pattern and possible reasons for successful aging, as well as provide rational suggestions for improving the elderly's state of life. In order to achieve healthy aging, a light diet and quality sleep should be advocated by the government, monitored by medical establishments, and carried out by the public.

Conflict of interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript have no conflicts of interest to declare.

Ethical review

The experiments comply with the current laws of China and received the support and cooperation of the local government of Hainan. All study participants provided informed consent, and the study design was approved by the ethics review boards of Institute of Geographical Sciences and Natural Resources Research. There are no conflicts of interest to declare.

Disclosure statement

The authors have no conflicts of interest to declare.

Author contributions

Writing-Review & Editing, Z.H.; Project administration, Y.L.; Supervision, X.Z.; Methodology, H.L. and Z.F.; Resources, L.C.; Data Curation, J.Q. and Z.W.; Investigation, Z.H., H.L., X.B. and Y.X.

Acknowledgments

This work was supported by the National Natural Science Foundation of China [grant numbers 41601560 & 41671499] and the Strategic Priority Research Program of the Chinese Academy of Sciences [grant number XDA19040303], as well as a grant from the scientific research fund of the Second Institute of Oceanography [grant numbers JG1532 & JG1610].

References

Aguilera, I., Daponte, A., Gil, F., Hernandez, A. F., Godoy, P., Pla, A., et al. (2008). Biomonitoring of urinary metals in a population living in the vicinity of industrial sources: A comparison with the general population of Andalusia, Spain. *The Science of the Total Environment, 407*, 669–678.

Araujo, L., Ribeiro, O., & Paul, C. (2017). The role of existential beliefs within the relation of centenarians' health and well-being. *Journal of Religion and Health, 56*, 1111–1122.

Basavaraj, S. (1993). Smoking and loss of longevity in Canada. *Canadian Journal of Public Health-Revue Canadienne De Sante Publique, 84*, 341–345.

Bastos Leite, A. J., Scheltens, P., & Barkhof, F. (2004). Pathological aging of the brain: An overview. *Topics in Magnetic Resonance Imaging, 15*, 369–389.

Benham, G. (2010). Sleep: An important factor in stress-health models. *Stress and Health, 26*, 204–214.

Berg, K. M., Kunins, H. V., Jackson, J. L., Nahvi, S., Chaudhry, A., Harris, K. A., Jr., et al. (2008). Association between alcohol consumption and both osteoporotic fracture and bone density. *The American Journal of Medicine, 121*, 406–418.

Bishop, A. J., Martin, P., Poon, L., & Johnson, M. A. (2011). Exploring positive and negative affect as key indicators of life satisfaction among centenarians: Does cognitive performance matter? *Journal of Aging Research, 2011* 953031-953031.

Bishop, A. J., Martin, P., Randall, G. K., MacDonald, M., & Poon, L. (2012). Exploring life satisfaction in exceptional old age: The mediating role of positive and negative affect. *Clinical Gerontologist, 35*, 105–125.

Bratzler, D. W., Oehlert, W. H., & Austelle, A. (2002). Smoking in the elderly–it's never too late to quit. *The Journal of the Oklahoma State Medical Association, 95*, 185–191 quiz 192-183.

Cho, H. J. (2015). Is sleep health a potential pathway to global mental health? *Sleep, 38*, 1837–1838.

Christensen, K., & Vaupel, J. W. (1996). Determinants of longevity: Genetic, environmental and medical factors. *Journal of Internal Medicine, 240*, 333–341.

Cicconetti, P., Tafaro, L., Tedeschi, G., Tombolillo, M. T., Ciotti, V., Troisi, G., et al. (2002). Lifestyle and cardiovascular aging in centenarians. *Archives of Gerontology and Geriatrics,* 93–98.

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion, 9*(3), 361–368.

Darviri, C., Demakakos, P., Charizani, F., Tigani, X., Tsiou, C., Chalamandaris, A. G., et al. (2008). Assessment of the health status of Greek centenarians. *Archives of Gerontology and Geriatrics, 46*, 67–78.

Dello Buono, M., Urciuoli, O., & De Leo, D. (1998). Quality of life and longevity: A study of centenarians. *Age and Ageing, 27*, 207–216.

Du, F., Qiukui, H., Birong, D., Changquan, H., Hongmei, W., Yanling, Z., et al. (2011). Association of osteoporotic fracture with smoking, alcohol consumption, tea consumption and exercise among Chinese nonagenarians/centenarians. *The Journal of Nutrition, Health & Aging, 15*, 327–331.

Felson, D. T., Zhang, Y. Q., Hannan, M. T., Kannel, W. B., & Kiel, D. P. (1995). Alcohol intake and bone-mineral density in elderly men and women - the framingham-study. *American Journal of Epidemiology, 142*, 485–492.

Forte, G., Deiana, M., Pasella, S., Baralla, A., Occhineri, P., Mura, I., et al. (2014). Metals in plasma of nonagenarians and centenarians living in a key area of longevity. *Experimental Gerontology, 60*, 197–206.

Franchini, M., & Mannucci, P. M. (2007). Short-term effects of air pollution on cardiovascular diseases: Outcomes and mechanisms. *Journal of Thrombosis and Haemostasis, 5*, 2169–2174.

Furihata, R., Uchiyama, M., Takahashi, S., Suzuki, M., Konno, C., Osaki, K., et al. (2012). The association between sleep problems and perceived health status: A Japanese nationwide general population survey. *Sleep Medicine, 13*, 831–837.

Ginter, E., & Simko, V. (2013). Women live longer than men. *Bratislava Medical Journal-Bratislavske Lekarske Listy, 114*, 45–49.

Gonos, E. S. (2000). Genetics of aging: Lessons from centenarians. *Experimental Gerontology, 35*, 15–21.

Gu, D., Sautter, J., Pipkin, R., & Zeng, Y. (2010). Sociodemographic and health correlates of sleep quality and duration among very old Chinese. *Sleep, 33*, 601–610.

Hale, L., Hill, T. D., Friedman, E., Nieto, F. J., Galvao, L. W., Engelman, C. D., et al. (2013). Perceived neighborhood quality, sleep quality, and health status: Evidence from the Survey of the Health of Wisconsin. *Social Science & Medicine, 79*, 16–22.

Hao, Z., Li, Y., Liu, Y., Li, H., Wang, W., & Yu, J. (2016). Hair elements and healthy aging: A cross-sectional study in Hainan Island, China. *Environmental Geochemistry and Health, 38*, 723–735.

Hao, Z., Liu, Y., Li, Y., Song, W., Yu, J., Li, H., et al. (2016). Association between longevity and element levels in food and drinking water of typical Chinese longevity area. *The Journal of Nutrition, Health & Aging, 20*, 897–903.

He, Y.-H., Lu, X., Tian, J.-Y., Yan, D.-J., Li, Y.-C., Lin, R., et al. (2016). Mitochondrial DNA plays an equal role in influencing female and male longevity in centenarians. *Experimental Gerontology, 83*, 94–96.

Headey, B., Kelley, J., & Wearing, A. (1993). Dimensions of mental-health – Life satisfaction, positive affect, anxiety and depression. *Social Indicators Research, 29*, 63–82.

Hoidrup, S., Gronbaek, M., Gottschau, A., Lauritzen, J. B., Schroll, M., Copenhagen, S., et al. (1999). Alcohol intake, beverage preference, and risk of hip fracture in men and women. *American Journal of Epidemiology, 149*, 993–1001.

Horley, J. (1984). Life satisfaction, happiness, and morale - 2 problems with the use of subjective well-being indicators. *Gerontologist, 24*, 124–127.

Jacobsson, L. J., Westerberg, M., & Lexell, J. (2010). Health-related quality-of-life and life satisfaction 6–15 years aftertraumatic brain injuries in northern Sweden. *Brain Injury, 24*(9), 1075–1108.

Jirong, Y., Changquan, H., Hongmei, W., & Bi-Rong, D. (2013). Association of sleep quality and dementia among long-lived Chinese older adults. *Age (Dordrecht, Netherlands), 35*, 1423–1432.

Jopp, D. S., Park, M. S., Lehrfeld, J., & Paggi, M. E. (2016). Physical, cognitive, social and mental health in near-centenarians and centenarians living in New York City: Findings from the Fordham Centenarian Study. *BMC Geriatrics, 16*, 1–10.

Larson, R. (1978). 30 Years of research on subjective well-being of older Americans. *Journals of Gerontology, 33*, 109–125.

Li, Y., Yang, L., Wang, W., Li, H., Lv, J., & Zou, X. (2011). Trace element concentrations in hair of healthy Chinese centenarians. *Science of the Total Environment, 409*, 1385–1390.

Li, Y., Bai, Y., Tao, Q. L., Zeng, H., Han, L. L., Luo, M. Y., et al. (2014). Lifestyle of Chinese centenarians and their key beneficial factors in Chongqing, China. *Asia Pacific Journal of Clinical Nutrition, 23*, 309–314.

Liu, H., Byles, J. E., Xu, X., Zhang, M., Wu, X., & Hall, J. J. (2017). Evaluation of successful aging among older people in China: Results from China health and retirement longitudinal study. *Geriatrics & Gerontology International, 17*, 1183–1190.

Luy, M., & Gast, K. (2014). Do women live longer or do men die earlier? Reflections on the causes of sex differences in life expectancy. *Gerontology, 60*, 143–153.

Lv, J., Wang, W., Krafft, T., Li, Y., Zhang, F., & Yuan, F. (2011). Effects of several environmental factors on longevity and health of the human population of Zhongxiang, Hubei, China. *Biological Trace Element Research, 143*, 702–716.

MacDonald, M., Martin, P., Margrett, J., Poon, L. W., & Georgia Centenarian, S. (2009). Correspondence of perceptions about centenarians' mental health. *Aging & Mental Health, 13*, 827–837.

Magnolfi, S. U., Noferi, I., Petruzzi, E., Pinzani, P., Malentacchi, F., Pazzagli, M., et al. (2009). Centenarians in Tuscany: The role of the environmental factors. *Archives of Gerontology and Geriatrics, 48*, 263–266.

Malmusi, D. (2015). Immigrants' health and health inequality by type of integration policies in European countries. *European Journal of Public Health, 25*(2), 293–299.

Martin, P., Poon, L. W., Kim, E. Y., & Johnson, M. A. (1996). Social and psychological resources in the oldest old. *Experimental Aging Research, 22*, 121–139.

Martin, P., Deshpande-Kamat, N., Poon, L. W., & Johnson, M. A. (2011). The model of developmental adaptation: Implications for understanding well-being in old-old age. In L. W. Poon, & J. Cohen-Mansfield (Eds.). *Understanding the well-being inthe oldest old* (pp. 65–78). UK: Cambridge University Press.

Masui, Y., Gondo, Y., Inagaki, N., & Hirose, N. (2006). Do personality characteristics predict longevity? Findings from the Tokyo Centenarian Study. *Age, 28*, 353–361.

McLaughlin, S. J., Connell, C. M., Heeringa, S. G., Li, L. W., & Roberts, J. S. (2010). Successful aging in the United States: Prevalence estimates from a national sample of older adults. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences, 65*, 216–226.

Milojevich, H. M., & Lukowski, A. F. (2016). Sleep and mental health in undergraduate students with generally healthy sleep habits. *PloS One, 11*, e0156372.

Mukamal, K. J., Robbins, J. A., Cauley, J. A., Kern, L. M., & Siscovick, D. S. (2007). Alcohol consumption, bone density, and hip fracture among older adults: The cardiovascular health study. *Osteoporosis International, 18*, 593–602.

Ozaki, A., Uchiyama, M., Tagaya, H., Ohida, T., & Ogihara, R. (2007). The Japanese Centenarian Study: Autonomy was associated with health practices as well as physical status. *Journal of the American Geriatrics Society, 55*, 95–101.

Passarino, G., De Rango, F., & Montesanto, A. (2016). Human longevity: Genetics or Lifestyle? It takes two to tango. *Immunity & Ageing, 13*(1), 12.

Perls, T., Levenson, R., Regan, M., & Puca, A. (2002). What does it take to live to 100? *Mechanisms of Ageing and Development, 123*, 231–242.

Pes, G. M., Tolu, F., Poulain, M., Errigo, A., Masala, S., Pietrobelli, A., et al. (2013). Lifestyle and nutrition related to male longevity in Sardinia: An ecological study. *Nutrition, Metabolism, and Cardiovascular Diseases, 23*, 212–219.

Pinquart, M., & Sorensen, S. (2001). Gender differences in self-concept and psychological well-being in old age: A meta analysis. *Journal of Gerontology, 56*(4), 195–213.

Plassman, B. L., Langa, K. M., Fisher, G. G., Heeringa, S. G., Weir, D. R., Ofstedal, M. B., et al. (2007). Prevalence of dementia in the united states: The aging, demographics, and memory study. *Neuroepidemiology, 29*, 125–132.

Rajpathak, S. N., Liu, Y., Ben-David, O., Reddy, S., Atzmon, G., Crandall, J., et al. (2011). Lifestyle factors of people with exceptional longevity. *Journal of the American Geriatrics Society, 59*, 1509–1512.

Revision of World Population Prospects (2017) https://population.un.org/wpp/.

Richard, M. R., & Edward, L. D. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology,* 141–166.

Robine, J. M., & Paccaud, F. (2005). Nonagenarians and centenarians in Switzerland, 1860-2001: A demographic analysis. *Journal of Epidemiology and Community Health, 59*, 31–37.

Ross, A., Yang, L., Klagholz, S. D., Wehrlen, L., & Bevans, M. F. (2016). The relationship of health behaviors with sleep and fatigue in transplant caregivers. *Psychooncology, 25*, 506–512.

Rowe, J. W., & Kahn, R. L. (1998). Succesful aging. *The Gerontologist, 37*, 433–440.

Samuelsso, S. M., Alfredson, B. B., Hagberg, B., Samuelsson, G., Nordbeck, B., Brun, A., et al. (1997). The Swedish centenarian study: A multidisciplinary study of five consecutive cohorts at the age of 100. *International Journal of Aging & Human Development, 45*(3), 223–253.

Sardadvar, S. (2015). How migrant status affects health beyond socioeconomic status: Evidence from Austria. *The International Migration Review, 49*, 843–877.

Smith, J., & Baltes, M. M. (1998). The role of gender in very old age: Profiles of functioning and everyday life patterns. *Psychology and Aging, 13*(4), 676–695.

Steven, N. A. (2006). Why women live longer than men: Sex differences in longevity.

Gender Medicine, 3(2), 79–92.
Tabulation of the 2000 population census of China (2000) http://www.stats.gov.cn/tjsj/pcsj/rkpc/5rp/index.htm.
Tabulation of the 2010 population census of China (2010) http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexch.htm.
Tafaro, L., Cicconetti, P., Baratta, A., Brukner, N., Ettorre, E., Marigliano, V., et al. (2007). Sleep quality of centenarians: Cognitive and survival implications. *Archives of Gerontology and Geriatrics, 44*(Suppl. 1), 385–389.
Tafaro, L., Cicconetti, P., Tedeschi, G., Baratta, A., Ursino, R., Ettorre, E., et al. (2004). Smoking and longevity: An incompatible binomial? *Archives of Gerontology and Geriatrics Supplement,* 425–430.
Taira, K., Tanaka, H., Arakawa, M., Nagahama, N., Uza, M., & Shirakawa, S. (2002). Sleep health and lifestyle of elderly people in Ogimi, a village of longevity. *Psychiatry and Clinical Neurosciences, 56*, 243–244.
Wang, L., Li, Y., Li, H., Holdaway, J., Hao, Z., Wang, W., et al. (2016). Regional aging and longevity characteristics in China. *Archives of Gerontology and Geriatrics, 67*, 153–159.
Wang, S. Q., Ying, J., Zhang, M. L., Shi, Y., Li, Y., Xing, Z. J., et al. (2018). Health-related life satisfaction and its influencing factors: A cross-sectional study in China. *Japan Journal of Nursing Science,* 285–297.
Wilkinson, T. J., & Sainsbury, R. (1998). A census-based comparison of centenarians in New Zealand with those in the United States. *Journal of the American Geriatrics Society, 46*, 488–491.
Willits, F., & Crider, D. (1988). Health rating and life satisfaction in the later middle years. *Journal of Gerontology, 43*, S172–176.
Yan, Z., Chang-Quan, H., Zhen-Chan, L., & Bi-Rong, D. (2012). Association between sleep quality and body mass index among Chinese nonagenarians/centenarians. *Age (Dordrecht, Netherlands), 34*, 527–537.