

Research Article

Correlation between Nutritional Status, Cognitive Function and Falling of Urban Elderly Population in Southwest China

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Abstract: Purpose: Currently, the injury and fatality rate associated with falling has gradually caused the attention of the scientists all over the world. However, the study on the risk factors causing the falling of elderly in southwest China is few. Therefore, this study aimed to cover this shortage to provide references for clinical care. Methods: epidemiological study was conducted on 823 elderly residents in Chongqing. Structured questionnaire was adopted to know about the basic information, living status, tumbling history and disease history of the subjects and some assessment tools such as International Physical Activity Questionnaire, Simple Nutrition Assessment Questionnaire and Cognitive Function Questionnaire were also applied for study. Results: 1) in the last year, 15.7% of the over 65-year-old elderly were falling in southwest China, which was obviously higher than that in western countries. 2) In terms of risk factors causing falling of the elderly, the top five risk factors were malnutrition, leg pain, drinking alcohol, poor eyesight and poor health status, the risk of falling of the elderly with such factors were 3.513, 3.266, 2.974, 1.912 and 1.905 times the risk of falling of those without such factors respectively. Conclusions: In the last year, there was a high proportion of the elderly in Southwest China who falling, mainly falling outdoors. The elderly with malnutrition, lower limbs pain, habit of drinking, poor eyesight and self-reported bad health status were at higher risk of falling.

Keywords: Falling, malnutrition, nutrition, nutrition assessment, the elderly

INTRODUCTION

Aging of population refers to the trend in which the proportion of the elderly in the whole population increases due to the decrease of the number of the young and the increase of the number of the elderly. Internationally, the countries or regions with over 60-year-old population accounting for 10% or over 65-year-old population for over 7% are deemed to enter the aging society. As it is said "aging before getting rich", China is a developing country with increasingly more serious aging problem. In 1999, China entered into aging society for the first time with over 10% aging population, which increased to 14.9% in 2014. It is predicted that, the aging rate will reach 18% by 2020 and 30% by 2039, when the number of the elderly in China will account for 1/4 of the total population (Li *et al.*, 2012; Wang, 2010). Under this trend, more attention shall be paid to the health problem of the elderly (Sohng *et al.*, 2004). Falling is one important reason out of various health problems causing the old to suffer disease or die. It's quite common to see falling of

the elderly. It is suggested in a study that, in Germany and the south of Australia, the rates of falling of the elderly are 17 and 30%, respectively (Gassmann *et al.*, 2009; Gill *et al.*, 2005). In Taiwan, it is pointed out in an investigation conducted on the elderly in 2007 that 19.6% of the 65-74 years old elderly and 29.6% of the over 75-year old elderly experienced falling (Health and Welfare Department of the Ministry of Health, 2013).

Falling seriously endangers the health conditions of the elderly and non-fatal falling will cause laceration or fractures (Morrison *et al.*, 2013), which will further affect the elderly's gait, balance and living ability (Chu *et al.*, 2006). For example, in Britain, 26% of the elderly community residents living in the long-term care institution receive care due to falling (Tinetti and Williams, 1997). Except for physical injury, falling can also cause the elderly's psychological fear, which may limit their own actions, eventually sharply lower the quality of their life (Howland *et al.*, 1993). Injuries caused by falling will increase medical expenses and social costs. Take the community elderly in Minnesota

of America for example, the average medical expense caused by damaging falling is USD 6,600 (Findorff *et al.*, 2007). According to one domestic investigation, the hospitalization expense of an inpatient who falling is 23.48% (Chen *et al.*, 2002) higher than that of one inpatient who doesn't falling. As discussed above, the falling of the elderly causes grave consequences on individuals and the society. The best solution is to take precautions. In 2010, American Geriatrics Society and British Geriatrics Society jointly published the clinical guidelines used to prevent the elderly from tumbling and it is pointed that: It should be noted in assessment and intervention that falling is caused by multiple factors such as age, sex, certain drugs, chronic diseases, balance disturbance (Cumming, 1998; Landi *et al.*, 2005). Currently, there are not many references about the study on risk factors causing the falling of the elderly in Mainland China. Only a few scholars get the relevant data mainly from the elderly in ordinary communities and care agencies. And there are less studies on the life situation of the community elder in the remote cities and towns. This study is mainly aimed to study on the risk factors causing the falling of this group of elder, so as to provide appropriate methods to prevent the elderly from falling.

MATERIALS AND METHODS

Subjects and sampling methods: In October 2013, the study is conducted on the elderly over 65-year-old from Beibei District in Chongqing. First, take the Senior Grade I and Senior Grade II students of Chaoyang Middle School, Jianshan Middle School and High School Affiliated to Southwest University as the research subjects, then randomly sample 5 classes from each school, 15 classes in total. After the head teachers know about the real situations of the sampled class students, every student from the family with the elderly over 65 year old would be given a questionnaire and asked to bring it home and assist the elderly family to fill. 823 out of 850 questionnaires are returned and 41 invalid questionnaires are excluded, with the valid ratio of questionnaires of 92%. The average age of the subjects is (70.7±5.6), with male accounting for 41.9% and female 58.1%.

Design of questionnaire: Structured questionnaires are adopted and 30 minutes are required to fill in each questionnaire. The contents of the questionnaire are compiled by relevant experts, mainly including:

Basic information about demography: Subject's marital status, education background, living form and occupation. For marital status, there are two options, with spouse or without spouse; for living form, living alone or not; for education background, illiterate or literate; for education background, socioeconomic status is calculated based on the Five Social Status

Index Method by Hollingshead and eventually the status is divided into the lowest level 1 and 2.

Living habits and states: In terms of the habit of smoking and drinking: the subject who smokes at least one packet of cigarettes within one month for half a year is deemed to have smoking habit; the subject who drinks alcohol at least once a week for over six months is deemed to have the habit of drinking (Chang *et al.*, 2010; Lin *et al.*, 2012).

Simple nutrition assessment questionnaire: The simplified version (Guigoz *et al.*, 1996; Gazzotti *et al.*, 2000) of the questionnaire commonly used for assessing the nutrition status of the elderly over the age of 65 will be applied. The questionnaire contains 6 questions with high credibility and validity. The total scores ≥ 12 means that the subject is without malnutrition risk; the total scores ≤ 11 means that the subject may be with malnutrition risk.

Health information: It's mainly about the subject's chronic disease history and falling history. Chronic disease includes high blood pressure, degenerative arthritis and diabetes (as self-reported). Falling: A certain part of body touching the ground due to unexpected tilt or unintentional posture change while standing, sitting or walking, or unexpected falling down to the ground or lower place. Falling history includes whether the subject once falling, falling times and the place the object fallings.

Self-reported health behavior: it's mainly about subjects' self-reported eyesight and health status. Self-reported health status is recorded in SF-36 questionnaire, one question of which is about subjects' self-identified current health status within one month. For "self-reported health status", there are three options, "good", "average" or "poor"; for self-reported eyesight, "good eyesight" and "poor eyesight".

IPAQT: The international version (Qu *et al.*, 2004) of IPAQ adopted by relevant scholars (Qu and Li, 2004) and approved by experts is applied. The main questions involve how many days are spent in strength-consuming work; moderately strength-consuming work, how many days with at least 10 minutes spent in walking and how much time are spent in sitting, within the last seven days. After all data are collected, physical activity amount can be calculated.

SPMSQ: This questionnaire is also adopted by the scholars at home and abroad, which including 10 questions. The higher the error rate is, the worse the elderly's cognitive function is (Pfeiffer, 1975). Scoring for right is replaced by the original scoring method to analyze the data and the score period of 8 to 10, 6 to 7, 3 to 5, 0 to 2 are defined as four levels, namely, complete cognitive function, mild impairment, moderate impairment and severe impairment.

Table 1: Risk factor statistics of falling in the elderly population

Related factor		Falling or not in last year		X ²	P
		Yes (123)	No(659)		
Age*	65-70 yrs	19 (15.4)%	108 (16.4%)	8.797	0.032<0.05
	71-75 yrs	30 (24.4%)	207 (31.4%)		
	76-80 yrs	29 (23.6%)	181 (27.5%)		
	81 and above	45 (36.6%)	157 (23.8%)		
Gender	Female	61 (49.6%)	341 (51.7%)	1.8790	0.170>0.05
BMI*	≤24	55 (44.7%)	188 (28.5%)	12.681	0.000<0.05
Social economical status	First	76 (61.8%)	389 (59.0%)	0.3280	0.567>0.05
Solitary or not	Yes	31 (25.2%)	122 (18.5%)	2.9480	0.086>0.05
Drinking or not*	yes	20 (16.3%)	57 (8.6%)	5.2910	0.021<0.05
Smoking or not	Yes	7 (5.7%)	52 (7.9%)	0.7190	0.396>0.05
Leg pain when walking or not*	Yes	48 (39.0%)	96 (14.6%)	41.268	0.000<0.05
Hypertension or not*	Yes	75 (61.0%)	302 (45.8%)	9.5270	0.002<0.05
Diabetes or not*	Yes	26 (21.1%)	67 (10.2%)	11.907	0.001<0.05
Self-evaluation vision status*	Good	56 (45.5%)	368 (55.8%)	4.4420	0.035<0.05
Self-rated health*	Good	25 (20.3%)	267 (40.5%)	67.060	0.000<0.05
	Average	63 (51.2%)	353 (53.6%)		
	Poor	35 (28.5%)	39 (5.9%)		
Nutritional assessment score*	<12	47 (38.2%)	90 (13.7%)	43.249	0.000<0.05
Cognitive function*	Good	9 (7.3%)	301 (45.7%)	178.918	0.000<0.05
	Mild disorder	21 (17.1%)	185 (28.1%)		
	Moderate disorder	32 (26.0%)	125 (19.0%)		
	Severe	61 (49.6%)	48 (7.3%)		

Mathematical statistics: The SPSS13.0 was used in this study, the statistical method involved descriptive statistics, independent sample T-test methods, chi-square test and Logistic regression analysis method. The significant level of all variables were set at p = 0.05.

RESULTS AND DISCUSSION

Demography and characteristics of physical fitness: It can be seen from Table 1 that, last year:

- From the investigated people, falling is related to age ($X^2 = 8.797$, $p < 0.05$) rather than sex ($X^2 = 1.879$, $p > 0.05$); female and male respectively account for 51.4% and 49.6% of all the people once falling. However, 65 to 70 year-old elderly account for 15.4%, 71 to 75 year-old for 24.5%, 76 to 80 year-old for 23.6% and over 81 year-old for 36.6%.
- From the investigated people, falling has nothing to do with the elderly's economic status and their living status ($X^2 = 0.328$ and 2.948 , both $p > 0.05$). Among the elderly once was falling, the ones ranking first-class economic status account for 61.8% and the ones living alone account for 25.2%. Falling is closely associated with Body Mass Index ($X^2 = 12.681$, $p < 0.05$). Among the tumbling people, the ones with over 24 BMI account for 55.3%. The ones with higher BMI are at higher risk of falling.
- Drinking can directly cause falling of the elderly. Among the 123 tumbling people, 20 are caused by drinking, accounting for 16.3%. It seems that smoking has nothing to do with falling.

- Viewed from physical fitness, lower limb pain, high blood pressure, diabetes, eyesight conditions, health status, nutrition conditions and cognitive function all can cause the falling of the elderly (corresponding to the Pearson chi-square value: 41.268, 9.527, 11.907, 4.442, 67.067, 43.249, 178.918; all $p < 0.05$). It can be proved by the facts: of the 123 tumbling people, 39.0% are with lower limb pain, 61.0% with high blood pressure, 21.1% with diabetes, 55.5% with poor eyesight, 28.5% with self-reported poor health status and 49.6% with severe cognitive impairment.

LOGISTIC REGRESSION RESULTS

It can be seen from Table 2 that:

- Among the variables applied to the regression equation, the main risk factors are age, drinking, lower limb pain, eyesight, health status and nutrition assessment scores, while the unobvious factors such as sex, economic status, living alone or not, blood pressure, diabetes and smoking are ignored.
- From the perception of odds ratio size, the odds ratio of the impact of age factor OR = 0.774 (0.717-0.834), that is, when the people of 71 years and above dropped to 65-70 years of age, the risk of falling will drop 77.4%; the odd rate of the impact of the drinking OR = 2.974 (0.807-1.107), i.e., the probability of occurrence of falling risk in the drinking people are 2.974 times to no-drinking; the leg pain OR = 3.266(0.807-1.107), i.e., patients with leg pain occurs falling risks are 3.266 times to those without leg pain; the status of the self-

Table 2: Primary parameters of regression equation

Related factor		Falling/unfalling (OR)		P
		B(659)	OR = Exp (β)	
Age	65-70 Yrs	-0.036	0.74 (0.717-0.834)	*
	71 and above (Base)	0.000	1.00	
Sex	Male	-0.009	0.911 (0.901-0.921)	
	Female (Base)	0.000	1.00	
Physical fitness		-0.008	0.992 (0.980-1.004)	
Social economical status	Others	-0.044	0.957 (0.807-1.107)	
Solitary or not	Level 1 (Base)	0.000	1.00	
Drinking or not*	Yes	-0.031	0.969 (0.807-1.107)	
Smoking or not	No (Base)	0.000	1.000	
Leg pain when walking or not*	Yes	1.090	2.974 (0.807-1.107)	**
Hypertension or not*	No (Base)	0.072	1.000	
Diabetes or not*	Yes	0.072	1.075 (0.807-1.107)	
Self-evaluation vision status*	No (Base)	0.000	1.000	
Self-rated health*	Yes	1.184	3.266 (0.807-1.107)	**
	No (Base)	0.000	1.000	
	Yes	0.100	1.105 (0.807-1.107)	
Nutritional assessment score*	No (Base)	0.000	1.000	
Cognitive function*	Yes	-0.036	0.965 (0.807-1.107)	
Social economical status	No (Base)	0.000	1.000	
Solitary or not	Poor	0.648	1.912 (0.807-1.107)	**
Drinking or not*	Good (Base)	0.000	1.000	
Smoking or not	Poor	0.644	1.905 (0.807-1.107)	**

assessment vision OR = 1.912 (0.807-1.107), namely self-assessment with poor eyesight is 1.912 times the risk of falling by good eyesight; and self-rated health status OR = 1.905 (0.807-1.107), that is, poor health is 1.905 times by good health; nutritional assessment score OR = 3.513 (0.807-1.107), i.e., those with poor nutritional status is 3.513 times the risk of falling by the good one..

ANALYSIS AND DISCUSSION

This study aimed to conduct an investigation on the urban elderly in Chongqing in southwest China to find out the risk factors causing them to falling. It has been found that 15.7% (123/782) of the over 65 year-old elderly in this municipality experience falling over the last year. The proportion is obviously higher than that of western counties. Falling can be deemed as a warning signal of the reduction of physical function for the elderly, thus falling history is an important basis for prevention and intervention. It is further found through interviews that: It is very common for the elderly residents in to falling outdoors, which is resulted from the terrain of Chongqing-a mountain city.

It can be seen from this investigation that: from the nutrition assessment results, the nutrition status score is the most important factor (OR = 3.513) to affect the elderly's physical function so as to cause tumbling. How the nutrition status causes tumbling needs further discussion. Between drinking and tumbling, there is an obvious relation. The ones drinking have 2.974 times risk of tumbling than the ones not drinking. This result is similar to some foreign scholars' study results: drinking can affect different aspects of the elderly such as athletic ability and mental state (Fink *et al.*, 1996; Moreland *et al.*, 2004).

It was concluded in the study that: self-reported health status is significantly related to falling, which means the worse the self-reported health status is, the higher the risk of tumbling is (OR = 1.905). This conforms to other study results (Clough-Gorr *et al.*, 2008). Lower limb pain during walking is also an important warning signal of tumbling for the elderly (OR = 3.266) and its importance of logistic regression model is only second to that of nutrition assessment scores. According to the studies and findings of some relevant scholars, lower limb pain may be significantly related to degenerative arthritis (Sturnieks *et al.*, 2004; Kelsey *et al.*, 2010). And arthritis has been confirmed as a risk factor causing tumbling. In addition, the subjects can rightly answer an average of 6 questions of the mental status questionnaire, which means that the subjects are with mild cognitive impairment. According to some relevant documents (Stump *et al.*, 2001; Talbot *et al.*, 2005), the ones with severe cognitive impairment are subject to an obvious higher death rate than the ones with mild impairment or without impairment. The compare between influences from different level cognitive functions (OR = 1.087) is statistically meaningless in this study. Probably just due to the subjects with moderate or severe cognitive impairment occupying a small proportion, Falling is not obviously related to cognitive function.

CONCLUSION

15.7% of the over 65-year-old elderly in southwest falling last year, which is obviously higher than western countries. Tumbling rate is related to age rather than sex, which conforms to the study results of many scholars.

According to the study, it's found that for the elderly tumbling is not related to economic status, living alone or not, smoking and other factors, which conforms to the opinions of a lot of scholars. On the other hand, it's also found that high blood pressure and diabetes are not related to tumbling, which is inconsistent to many scholars' opinion. What causes this inconformity needs further discussion.

Among the risk factors causing the falling of the elderly, malnutrition is the most important one, lower limb pain while walking ranking second, drinking third, poor eyesight fourth, self-reported bad health status fifth.

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