



The association of falls and various physical activities in Chinese nonagenarians/centenarians



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ABSTRACT

Little is known about the relationship between falls and various physical activities in the oldest old people. This study was conducted to observe the association of fall with various exercise habits and farm work in very old people. In this cross-sectional study of a Chinese cohort of men and women aged 90–108 years, we observed the association of fall with habitual (current and former) farm work and exercise in very old people. The population included 805 unrelated Chinese nonagenarians and centenarians (68.94% of the subjects were women, with a mean age of 93.70 years). In the women, the subjects with a continuing exercise habit had a significantly lower prevalence of fall than those without an exercise habit; the subjects who had never exercised had a significantly higher prevalence of fall than those who exercised. In men, there was no significant difference in the prevalence of these habits between the subjects with and without fall. After adjusting for age, gender, body mass index, educational levels, life styles, vision levels and temperament, we found that current habitual farm work (OR = 1.755 95% CI (1.107, 2.780)) and exercise OR = 0.666 95% CI (0.445, 0.997) had a significant odds ratio for fall; among the females, continuing exercise (vs. having never exercised) had a significant odds ratio for fall (OR = 0.620 95% CI (0.395, 0.973)). Habitual farm work might be positively associated with fall; however, habitual exercise might be negatively associated with fall in Chinese long-lived old people.

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1. Introduction

Falls are a common and serious public health problem of old people. Approximately 30% of community-dwelling people over 65 years old fall at least once each year, and approximately 1 in 40 of them are hospitalized (Rubenstein, 2006; Tinetti et al., 1994). Falls can cause injuries, and the most frequent were fractures and head injuries, which cause substantial health care costs and mortality as well as being major contributors to immobility and premature nursing home placement (Keene, Parker, & Pryor, 1993; Peel, Kassulke, & McClure, 2002; Rubenstein, 2006). Falls could cause psychological damage, especially fear of falling, which was correlated with avoidance of activity and predicted avoidance in activity 6 months later, resulting in loss of functional independence and social interactions (Yardley & Smith, 2002). The definition of fall should be clear to researchers and medical care

professionals. Although fall had various meanings in published studies, a consensus report defines fall as “an unexpected event in which the participant comes to rest on the ground, floor, or lower level” (Lamb et al., 2005; Zecevic, Salmoni, Speechley, & Vandervoort, 2006). The consensus recommended assessors asking subjects about fall with the following sentence: “In the past month, have you had any fall including a slip or trip in which you lost your balance and landed on the floor or ground or lower level?” (Lamb et al., 2005). Falls in old people alarm the entire family and are an independent predictor for long-term admission to a nursing home or a hospital (Tinetti & Williams, 1997). It is unclear to what extent interventions conducted to prevent falls would prevent hip or other fall-associated fractures. Many epidemiological studies have been conducted to identify the risk factors for falling such as muscle weakness, gait deficit, and visual deficit, and a recent systematic review synthesized these data (American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001; Deandrea et al., 2010; Rubenstein, 2006). Approximately 70% of falls were caused by multiple interacting factors; approximately 15% of falls result from an external event or a single identifiable cause such as syncope (Campbell & Robertson, 2006). Falls and fall-related

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injuries increase with age and are approximately twice as frequent for persons more than 75 years old (Peel et al., 2002; Rubenstein, 2006; Tinetti et al., 1994).

As the population of older persons increases, the number of falls among older individuals is expected to rise (Franco, Pereira, & Ferreira, 2013; Gillespie et al., 2012). After two birth peaks and the “one child” policy, China is facing unprecedented challenges with regard to its aging population. The increasing rate for people over 90 years old is as high as 7.1%, whereas the total population growth rate is 0.4% (Jia, 2009). According to the 2010 census, the population over 60 years old is 177 million (National Bureau of Statistics of People's Republic of China, 2011). The incidence of falls in China varied from 10% to 44% among community-dwelling people over 60 years old. Compared to men and those who live in urban areas, women and those who live in rural areas have a lower incidence rate; the rate increased with age (Yu, Qin, Wu, Yao, & Wu, 2006; Wang, Chen, & Song, 2010).

Physical activity influences the incidence of fall in old people and is divided into exercise and farm work in China. Previous studies showed that exercise including Tai Chi and aerobic exercise could prevent falls in old people (Franco et al., 2013; Qin, Yu, Zhu, Wu, & Wu, 2006). Approximately 85 million old people live in the countryside, and 65% of them are not covered by the welfare system and must do farm work (Wu, 2007). An increasing number of old people have no children at home, which prolongs their farm work time (Li & Song, 2009). The burden of farm-work-related injuries is substantial and increased in Saskatchewan, Canada from January 1990 to December 2004 (Shah, Hagel, Lim, Koehncke, & Dosman, 2011). Furthermore, 13–19% work-related injuries caused by falls (Day et al., 2009; McCurdy et al., 2004) and the monetary cost of injuries is high (Rautiainen, Lange, Hodne, Schneiders, & Donham, 2004). To the best of our knowledge, no study has compared the different functions of exercise or farm work and fall among people aged 90 and above. In this study, we aimed to examine the association of fall with habitual exercise and farm work in oldest-old people using a cohort of Chinese men and women aged 90–108 years.

2. Subjects and methods

2.1. Study subjects

This study is part of the Project of Longevity and Aging (PLAD), which was conducted in Dujiangyan, which has 2311,709 inhabitants and is outside the urban area of ChengDu. The PLAD study included 870 subjects aged 90 years and older; 32.6% of the subjects were women, and 67.4% were men. In April 2005, 870 persons aged 90 years or more were selected from the population. The study protocol was approved by the Research Ethics Committee of Sichuan University. Informed consent was obtained from all the participants (as well as from the heirs or legal proxies). Trained personnel visited all the study participants at their homes for the data collection, biological specimen collection, and anthropometric measurements. The sociodemographic characteristics and lifestyle habits were collected using a general questionnaire. We excluded the subjects with cancer, end-stage disease, missing information on fall status or missing information on habits of exercise and farm work. We included 805 participants (68.94% were women, with a mean age of 93.70 years) in the analysis.

2.2. Data collection and measurements

2.2.1. Assessment of falls

The participants self-reported whether they had fallen in the past one year. Fall was defined as “having one or more falls in the past one year”. In the review process, we used the recommended

sentence as follows: “In the past one year, have you had any fall including a slip or trip in which you lost your balance and landed on the floor or ground or lower level? If yes, how many falls did you have?” (Lamb et al., 2005). If the participants were unable to answer because of sensory-motor or mental impairment, the information was sought from relatives, family members and/or caregivers.

2.2.2. Assessment of exercise and farm work habits

Exercise includes all types of leisure time physical training including walking, playing ball, jogging, and Tai Chi. Farm work includes all types of work on a farm. To assure the reliability of the collected data, a current habit was defined as an activity done by a subject almost every day, and a former habit was defined as an activity done by a subject almost every day for 10 years, 20 years, or more ago. The finished questionnaire was verified by the family members who usually lived with the participants.

2.2.3. Assessment of covariates

Based on the questionnaire prepared for the medical record, a standardized enquiry concerning the self-reported medical history, medication, standardized physical examination, anthropometric measurements and a 12-lead electrocardiogram were undertaken by trained study personnel in personal interviews. Height and weight of the subjects in light clothing and no footwear were measured by a wall-mounted stadiometer and a calibrated scale to the nearest 1 kg. The body mass index (BMI) was calculated by dividing the weight in kilograms by the height in meters squared. The 30-item MMSE was used to measure the cognitive function status. The assessment tool is a global test that contains items of orientation, attention, calculation, language and recall and was reported previously in PLAD study (Wang, He, & Dong, 2015). For majority of participants were illiterate, cognitive impairment was considered possible if the MMSE score less than 18, which has been shown to be 80% to 90% sensitive and 80% to 100% specific for a diagnosis of cognitive impairment among Chinese people (Cui et al., 2011). The information obtained included the following: age, gender, and dietary habits. Some strategies were used to decrease the bias and assure methodological reliability, include the following: (1) trained study personnel conducted the face to face interviews; (2) the administrator reviewed the data collection procedure and grading system; and (3) the administrator observed a geriatrician conduct the test on the residents.

2.3. Statistical analysis

In this study, the continuous clinical outcomes are presented as the means \pm standard deviation ($M \pm S.D.$). Some variables are presented as dichotomous variables. The baseline characteristics were compared using an unpaired Student's *t*-test or the chi-square or Fisher's exact test. Binary logistic analyses were performed to evaluate the association between the potential predictors, including some confounding factors, which were used to analyze the relationship between fall and habitual exercise and farm work. We calculated the 95% confidence interval (CI) for each odds ratio. A *P*-value < 0.05 was considered statistically significant, and all of the *P*-values are two sided. All of the statistical analyses for this study were conducted with the SPSS for Windows software package, version 11.5 (SPSS, Inc., Chicago, USA).

3. Results

3.1. The prevalence rates of fall, habits of exercise and farm work and baseline characteristics of the subjects

Among the 805 volunteers, the mean age was 93.70 ± 3.42 (range 90 to 108 yr), and 555 (68.94%) were women, including 62

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