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Age-related changes in prevalence and symptom characteristics in kidney deficiency syndrome with varied health status: a cross-sectional observational study

Yin Zhang ^{a,1}, Yue Liu ^{b,1}, Xianping Li ^c, Yuezhou Chen ^d,
Hui Ye ^a, Xiaofeng Li ^e, Zihan Lin ^f, Zheng Wang ^c, Wei Huang ^c,
Xia Ding ^{c,*}

^a Dongzhimen Hospital Affiliated to Beijing University of Chinese Medicine, Beijing, China

^b Dongfang Hospital Affiliated to Beijing University of Chinese Medicine, Beijing, China

^c Beijing University of Chinese Medicine, Beijing, China

^d China Academy of Chinese Medical Sciences, Beijing, China

^e Changping District Hospital of Integrative Medicine, Beijing, China

^f Quanzhou Hospital of Traditional Chinese Medicine, Quanzhou, China

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Abstract *Objective:* This study aimed to reveal the age-related changes in prevalence and symptom characteristics in kidney deficiency syndrome (KDS) with varied health status.

Methods: This cross-sectional observational study was conducted in 6 hospitals. Investigators queried participants aged 20–79 about their health, including symptoms if any, and completed questionnaires to collect participants responses. Prevalence, severity, and frequency of KDS and other relevant parameters were observed and recorded. Comparative analysis of countable variables, including prevalence, was performed by frequency analysis and χ^2 test and expressed as a composite ratio. Comparative analysis of quantitative scores of the severity and frequency of symptoms was performed by the rank-sum test. Regression analysis of the correlation of KDS with potential contributing factors was performed by non-conditional binary logistic stepwise regression of numerical variables.

Results: Prevalence of KDS in healthy and unhealthy participants correlated with increasing age ($P < 0.05$). In those with chronic disease, KDS prevalence was comparatively high, but

* Corresponding author. Beijing University of Chinese Medicine, No.11, North Third Ring Road, ChaoYang District, Beijing, 100029, China. Tel./fax: +86 10 6428 6576.

E-mail address: dingx@bucm.edu.cn (X. Ding).

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¹ These authors contributed equally to this work.

the trend was not obvious. KDS prevalence in participants age 20–39 showed an increasing trend with deteriorating health ($P < 0.05$). Compared to healthy individuals, KDS prevalence in subhealthy persons and those with chronic disease showed an increasing trend ($P < 0.05$) in the 40–59 and 60–79 age groups, whereas there was no difference between subhealthy persons and those with chronic disease age 40–59 and 60–79. Symptom severity scores of KDS showed an increasing trend with increasing age and deteriorating health status ($P < 0.05$). Higher symptom frequency scores were also positively correlated with increasing age ($P < 0.05$), but health status deterioration was not significantly correlated ($P > 0.05$). Age, health status, lower back pain, shin soreness or heel pain, tinnitus or deafness, hair loss or loose teeth, incomplete bladder emptying or incontinence, and sexual dysfunction or infertility were potential factors contributing to KDS ($P < 0.05$), but age was the only independent variable for which OR > 1 . Moreover, the distribution of typical KDS-related symptoms showed dramatic regularities.

Conclusion: Prevalence and symptom characteristics of KDS were found to increase consistently with increasing age and deteriorating health status. Kidney deficiency may be an important mechanism of aging in the subhealthy and chronic disease states.

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Introduction

China has been the most populous country for thousands of years, and its population is now aging at an unprecedented rate.¹ According to the sixth national census data published by the National Bureau of Statistics of China in 2010, over the past 60 years, the elderly population has increased from 4.1% in 1960 to 13.3% in 2009, or from 25 million in 1960 to 130 million in 2009.² The United Nations predicts China will have an estimated 438 million elderly in China by 2050, accounting for 21.8% of the world's elderly population (2 billion).^{3,4} Although longevity is the result of good health and global health improvement, the growing demand for health services is an enormous challenge for medical and social services.⁴

Aging is an inevitable process accompanying the passage of time. In Western medical theory, aging is the result of complex factors including stress, injury, infection, immune function deterioration, nutritional deficiencies, and metabolic disorders. Traditional Chinese medicine (TCM) has a history of more than 3000 years with unique theories regarding etiology, diagnosis and treatment⁵ that have been established on the basis of the unique ancient Chinese philosophic concept of "wholism". According to this holistic concept, aging is an ongoing, hierarchical, pathophysiologic process with symptoms and signs resulting from the functional deterioration of the whole body, including the organs, channels and collaterals, Qi, blood, Yin and Yang.

The aging theory of kidney deficiency has been a core TCM aging theory for thousands of years.⁶ According ancient TCM literature, such as the *Yellow Emperor's Canon of Internal Medicine*, there is a close relationship between aging and kidney deficiency. The deficiency of the five organs, led by kidney dysfunction, is a vital pathophysiologic characteristic of the elderly that accelerates the aging process.

TCM research has focused on the hypothalamus-pituitary-target gland axis, free radicals, the immune

system, gene regulation, the construction of kidney deficiency syndrome (KDS) questionnaires, and KDS models,^{7–13} which represent a shifting paradigm from the holistic concept to a systematic and biological viewpoint that is objective and quantitative.¹⁴

Epidemiologic studies have shown that kidney deficiency prevalence increases by half for both males and females from 60% at 40 years of age to 90% at age 70 and older, increasing at a rate of 10% every 10 years.^{15,16} Compared with young and middle-aged persons, the elderly have a much higher prevalence of deficiency syndromes for both persons who are ill and non-ill with KDS,^{17–19} the most common syndrome severity increasing with age.²⁰ Kidney deficiency is one of the key factors throughout the entire aging process, and there is a significant correlation between nourishing the kidney and mitigating the effects of aging. The potential relationship between kidney deficiency and sub-health or chronic disease states has also been mentioned in a series of epidemiological studies. KDS is one of the most common syndromes in sub-healthy persons and those with chronic disease. In addition, KDS has been found to be complicated by syndromes in the conditions mentioned above.^{21–24}

Existing studies on KDS have several limitations. Few are multi-centered or have a large sample sizes. Most lack quality control and none elucidate age-related changes in prevalence, symptom severity, symptom frequency, or symptom distribution. None have focused on the potential differences in prevalence and symptom characteristics in the healthy, sub-healthy, and persons with chronic disease for detailed comparison. Therefore, it is important to elucidate the age-related changes in prevalence and symptom characteristics in kidney deficiency syndrome for varied health status by undertaking a multi-centered and large sample-sized cross-sectional observational study with strict quality control.

Because patient-reported symptoms identified by observation are important for indicating the existence of

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