

The Comparison of Comprehensive Geriatric Functions of Community-Dwelling Elderly People Living in Cotahuasi and Puyca Located in La Union Province, Arequipa, Peru

Wenling Chen¹⁾, Kiyohito Okumiya³⁾, Yasuko Ishimoto²⁾,
Yumi Kimura²⁾, Hisei Imai¹⁾, Eriko Fukutomi¹⁾,
Reiko Hozo⁴⁾, Motonao Ishikawa⁴⁾, Kozo Matsubayashi²⁾

- 1) Department of Field Medicine, School of Public Health, Kyoto University, Kyoto, Japan
- 2) Center for Southeast Asian Studies, Kyoto University, Kyoto, Japan
- 3) Research Institute for Humanity and Nature, Kyoto, Japan
- 4) Department of Internal Medicine, Medical Center East, Tokyo Women's Medical University, Tokyo, Japan

More than 140 million people worldwide live in over 2500 meters highland above sea level. Of them, 80 million live in Asia, and 35 million live in the Andean mountains. This article described the comparison of the comprehensive geriatric functions of community-dwelling elderly people living in Cotahuasi and Puyca located in La Union Province, Arequipa, Peru. The study population consisted of 240 highlanders (mean age: 69.5, male/female: 85/155) living in Cotahuasi (altitude 2,600-2,700 m), Pampamarca (3,000-3,300 m), Puyca (3,600 m), and Churca (3,800 m). All of these towns are located in La Union Province, Arequipa, Peru. Cotahuasi is the capital of La Union Province, and Pampamarca is a rural suburb. Puyca and Churca are rural villages located at higher altitudes (>3,500 m) along an upper tributary of the Cotahuasi River. The medical survey of community-dwelling elderly people living in these towns was carried out in August in 2010. The scores in ADL, TMIG, FRI, GDS and subjective QOL between Cotahuasi and Puyca were significant differences. The mean age of subjects in Cotahuasi was significantly higher than those in Puyca. The percentage of subjects with diabetes and taking diabetes medicine were significantly higher in Cotahuasi people than in Puyca ones. The percentage of history of stroke and oseoarthopathy were significantly higher in Cotahuasi than in Puyca. We should pay attention to the approximately 10% of the total population in the world were living in mountain areas where socioeconomic globalization was increasing. Further investigations must remit the prevalence of lifestyle-related disease and human ageing phenomena in highlanders.

Introduction

More than 140 million people worldwide live in over 2500 meters highland above sea level. 80 million highlanders live in Asia, and 35 million highlanders live in the Andean mountains.¹⁾

Over the past several decades, Andean regions have experienced many socioeconomic changes, including the implementation of agrarian reform policies and increased integration into a market

economy. Local changes in southern Peru have included improved transportation networks, new markets, an expanded public school system, and improved health care facilities. Lifestyle-related disease and ageing phenomena have been found to be associated with social and economic development throughout the developing world, including Peru.²⁾

Highlanders have maintained their traditional livelihoods exerting their ingenuity with limited

environmental resources and adapting their bodies to hypoxic environments. However, recent economic and social globalizations (e.g. monetary economy and marketism, acceleration of information delivery, rapid development of transportation and growing ageing society) are mounting even to high altitude areas including Qinghai and Tibet in China.³⁾ In previous study, activities of daily living (ADL), subjective quality of life (QOL), erythrocytosis, food diversity and actual features of metabolic syndrome of community-dwelling elderly highlanders living in Haiyan Country in Qinghai in China were reported.³⁻⁶⁾ However, there have been few studies discussed about health situation of elderly people who living in the Andean mountains. This article described the comparison of the comprehensive geriatric functions of community-dwelling elderly people living in Cotahuasi and Puyca located in La Union Province, Arequipa, Peru.

We have carried out a comprehensive geriatric survey in Cotahuasi and Puyca in Peru in 2010 as one research in the chain of the project of research Institute of Humanity and Nature (Kyoto) entitled "Human Life, Aging, and Disease in High-Altitude Environments: Physiomedical, Ecological and Cultural Adaptation in "Highland Civilization."

Methods

Subjects

The study population consisted of 240 highlanders (mean age: 69.5, male/female: 85/155) living in Cotahuasi area (Cotahuasi 2600m & Pampamarca 3000m) and Puyca area (Puyca 3600m & Churca 3900m). Population of Puyca area 3368 (Puyca 2459, Churca 909) including 331 over 60 years old and more according to the information of Alca Clinic in 2010. Population of Cotahuasi area 5031 (Cotahuasi 3200, Pampamarca 1831) according to the information of Cotahuasi Clinic in 2010, without information of population over 60 years old and more. The subjects were volunteers who hoped to be examined in response to our announcement of health examination. All of these towns are located in La Union Province, Arequipa, Peru. Cotahuasi is the capital of La Union

Province, and Pampamarca is a rural suburb. Puyca and Churca are rural villages located at higher altitudes (>3,500 m) along an upper tributary of the Cotahuasi River. The medical survey of community-dwelling elderly people living in these towns was carried out in August in 2010.

Items on the comprehensive geriatric assessment

Comprehensive geriatric assessment (CGA) in the study consisted of assessments of ADL, symptoms of depression, and quantitative subjective QOL, current medical situations, past medical histories, current daily life style and social background. In their ADL assessment, participants rated their status in seven areas (walking, ascending and descending stairs, eating, dressing, using the toilet, bathing, grooming) with regard to required assistance from 3 to 0 (3 = completely independent, 2 = some help required, 1 = a lot of help required, 0 = completely dependent). The scores were added, resulting in scores in basic ADL ranging from 0 to 21, with low scores indicating disability.⁷⁻¹¹⁾ To attain a higher-level of ADL assessments, participants rated their ability using the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC),^{12,13)} which consists of a 13-item index that includes three sublevels of competence: instrumental self-maintenance (five items rated on a yes/no basis: the ability to use public transport, buy daily necessities, prepare a meal, pay bills, handle banking matters), intellectual activity (four items rated on a yes/no basis: the ability to fill in forms, read books or magazines and interest in television programs or news articles of health-related matters) and social role (four items rated on a yes/no basis: the ability to visit friends, give advice to relatives and friends who confide, visit someone in the hospital and have conversation with young people). We screened for symptoms of depression using the Japanese version of the 15-item Geriatric Depression Scale (GDS-15).^{14,15)} The 21-item Fall Risk Index (FRI-21),^{16,17)} developed by the Fall Prevention Group of Ministry of Health, Labor and Welfare, was also assessed. Quantitative subjective QOL was assessed using a 100-mm visual

analog scale (with the worst QOL on the left end of the scale, and the best on the right).¹⁸⁾ The following five QOL items were measured: (i) subjective sense of health, (ii) relationship with family, (iii) relationship with friends, (iv) financial satisfaction, and (v) subjective happiness.

These surveys were approved by the Ethical Committee of the Research Institute of Humanity and Nature and Medical Institute and written informed consent was obtained from each participant.

Statistical analysis

Statistical analysis was carried out using SPSS (SPSS, Chicago, IL, USA). Students' T-test comparisons analysis was used for continuous variables between two categories, and the chi square test was used for categorical variables. *P*-values less than 0.05 were used to show statistical significance.

Results

The participants were divided into 122 subjects lived in Cotahuasi and 118 subjects lived in Puyca. Table 1 shows the comparison of baseline characteristics

between Cotahuasi and Puyca community-dwelling elderly. The mean age of subjects in Cotahuasi was significantly higher than those in Puyca. After adjusting for the effect of age, we found that scores in basic ADL and social role of TMIG-IC were significantly higher in Puyca people than in Cotahuasi. However, the scores in FRI and intellectual activity of TMIG-IC was significantly higher in Cotahuasi people than in Puyca. The percentage of GDS-15 screening-based depression (scores of 6 or more, and scores of 10 or more) was significantly higher in Cotahuasi people than those in Puyca. Although there were no significant differences in five QOL items.

Figure 1 shows the comparison of percentage of medical situation. There were no significant difference in percentage of subjects with hypertension disease and taking antihypertension medicine between Cotahuasi and Puyca. Although the percentage of subjects with diabetes and taking antidiabetes medicine were significantly higher in Cotahuasi people than in Puyca ones.

Figure 2 shows the comparison of medical history. The percentage of history of stroke and osteoarthritis

Table 1 The comparison of baseline characteristics between Cotahuasi and Puyca community-dwelling elderly.

	Cotahuasi N=122	Puyca N=118	p-value
Age, mean±SD	73.1±8.2	66.9±8.2	<0.001
<u>ADL, mean±SD</u>			
Basic ADL (range0–21)	19.2±3.3	20.1±2.3	0.014 *
<u>TMIG-IC (range0–13)</u>	8.7±3.6	8.0±3.0	NS
Self-maintenance (range0–5)	3.7±1.6	3.6±1.4	NS
Intellectual activity (range0–4)	2.0±1.4	1.1±1.4	<0.001 *
Social role (range0–4)	2.9±1.3	3.3±1.0	0.02 *
<u>GDS (range0–15)</u>	8.1±4.0	5.5±3.6	<0.001
<u>GDS ≥ 6 (%)</u>	69.7	41.4	<0.001
<u>GDS ≥ 10 (%)</u>	40.2	15.5	<0.001
<u>FRI-21</u>	11.8±3.5	9.4±3.9	<0.001
<u>QOL, mean±SD (range0–100)</u>			
Subjective sense of health	42.6±22.8	47.6±25.0	NS
Relationship with family	68.2±27.8	69.6±21.3	NS
Relationship with friends	70.9±23.0	69.3±20.0	NS
Financial satisfaction	36.7±21.3	37.0±20.4	NS
Subjective happiness	54.3±26.7	57.6±22.5	NS

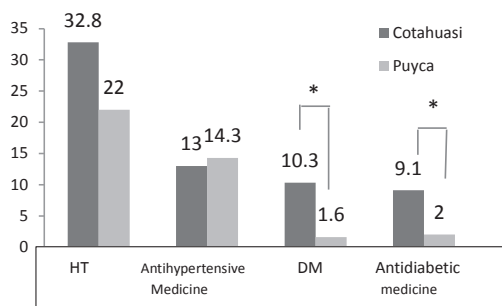


Figure 1 The comparison of percentage of medical situation between Cotahuasi and Puyca.

were significantly higher in Cotahuasi than in Puyca. There was no significant difference in History of bone fracture and heart disease.

Discussion

This article described the comparison of the comprehensive geriatric functions of community-dwelling elderly people living in Cotahuasi and Puyca located in La Union Province, Arequipa, Peru. Because of socioeconomic globalization, in urban Cotahuasi the community-dwelling people were getting much food and using transportation instead of walking. In rural Puyca, nomadized alpaca and llama pastoralism and agriculture have been conducted on the plateaus and in the canyons. This clear separation of land use made differences between Cotahuasi and Puyca.

There are several risk factors for elderly people getting stroke. In previous study, discovered in 1909, Chagas disease was progressively shown to be widespread throughout Latin America, affecting millions of rural people with a high impact on morbidity and mortality. In that particular period, there is no vaccine or specific treatment available for large-scale public health interventions, the main control strategy count on prevention of transmission, principally by eliminating the domestic insect vectors and control of transmission by blood transfusion.¹⁹⁾ This article revealed prevalence of stroke in Cotahuasi was significantly higher than Puyca (23.7 vs 12.6), we supposed that the large number of participants who

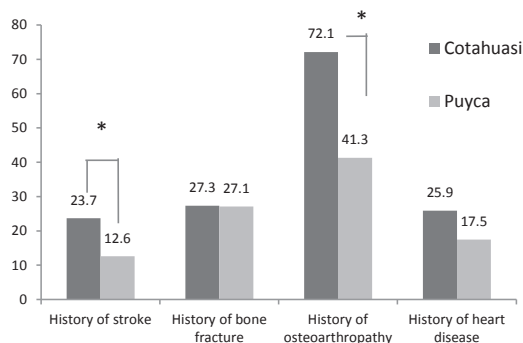


Figure 2 The comparison of percentage of medical history between Cotahuasi and Puyca.

have the past history of stroke, maybe Chagas' disease was a risk factor for stroke.

This article described the comparison of the comprehensive geriatric functions of community-dwelling elderly people living in Cotahuasi and Puyca located in La Union Province, Arequipa, Peru. The mean score of Basic ADL was significantly higher in Puyca people than in Cotahuasi ones (20.1 vs 19.2). We supposed that Puyca elderly people maintained their traditional livelihood (less varied diets and nomad lifestyle) until now was one factor to influence Basic ADL scores higher than Cotahuasi ones.

The prevalence of Diabetes was higher in people living in urban Cotahuasi areas than in rural Puyca areas (10.3% vs 1.6%). The community location was supposed to greatly influence the increase in Diabetes. The effect of socioeconomic globalization is affecting highland areas and traditionally lifestyle at high altitudes are changing to modern. Economic status was supposed to greatly influence the prevalence of Diabetes in the elderly highlanders in urban Cotahuasi, with the background of developing market economy which made them easy to get various food if they were affordable. The inclinations of metabolic syndrome in the highlander were paid more attention.

In conclusion, the effect of socioeconomic globalization might have influenced the community-dwelling people living in Cotahuasi with lower Basic ADL than in Puyca ones. Modernization might have a good aspect in convenient life. However, it might bring

another negative aspects, for example, exercise frequencies was decreased or varied diets. We should pay attention to the approximately 10% of the total population in the world were living in mountain areas and the socioeconomic globalization was increasing in high altitudes. Further investigations must remit the prevalence of lifestyle-related disease and human ageing phenomena in highlanders.

Reference

- 1) Chronic hypoxia in Andeans; are there lessons for neurology at sea level? May 2006. [on line]. [Cited 15 Aug 2012.] Available from URL: <http://lib.bioinfo.pl/>
- 2) Leatherman, T.L., Carey, J.W., Thomas, R.B. Socioeconomic change and patterns of growth in the Andes. *American Journal of Physical Anthropology* 1995;97 (3): 307-321.
- 3) Matsubayashi K, Okumiya K, Sakamoto R et al. Comprehensive geriatric assessment of elderly highlanders in Qinghai, China I: Activities of daily living, quality of life and metabolic syndrome. *Geriatr Gerontol Int.* 2009 Dec;9(4):333-41.
- 4) Okumiya K, Sakamoto R, Kimura Y et al. Comprehensive geriatric assessment of elderly highlanders in Qinghai in China II: The association of erythrocytosis with life-style related diseases among the three ethnics compared with Japan. *Geriatr Gerontol Int.* 2009 Dec;9(4):342-51.
- 5) Kimura Y, Okumiya K, Matsubayashi K et al. Comprehensive geriatric assessment of elderly highlanders in Qinghai in China III: Comparison of food diversity and its relation to the health between Han and Tibetan elderly. *Geriatr Gerontol Int.* 2009 Dec;9(4):352-8.
- 6) Sakamoto R, Matsubayashi K, Kimura Y et al. Comprehensive geriatric assessment of elderly highlanders in Qinghai in China IV: Oxidative stress in Tibetan and Han elderly highlanders. *Geriatr Gerontol Int.* 2009 Dec;9(4):359-65.
- 7) Matsubayashi K, Okumiya K, Wada T et al. Secular improvement in self-care independence of old people living in community in Kahoku, Japan. *Lancet* 1996; 347: 60.
- 8) Matsubayashi K, Okumiya K, Wada T et al. Postural dysregulation in systolic blood pressure is associated with worsened scoring on neurobehavioral function tests and leukoaraiosis in the older elderly living in a community. *Stroke* 1997; 28: 2169-2173.
- 9) Matsubayashi K, Okumiya K, Wada T et al. Improvement in self-care independence may lower the increasing rate of medical expenses or community-dwelling older people in Japan. *J Am Geriatr Soc* 1998; 6: 1484-1485.
- 10) Matsubayashi K, Okumiya K, Osaki Y et al. Frailty in elderly Japanese. *Lancet* 1999; 353: 1445.
- 11) Ho HK, Matsubayashi K, Wada T et al. Factors associated with ADL dependence: a comparative study of residential care home and community dwelling elderly in Japan. *Geriatr Gerontol Int* 2002; 2: 80-86.
- 12) Koyano W, Shibata H, Nakazato K et al. Measurement of competence: reliability and validity of the TMIG-index of competence. *Arch Gerontol Geriatr* 1991; 13:103-116.
- 13) Ishizaki T, Watanabe S, Suzuki T et al. Predictors for functional decline among nondisabled older Japanese living in a community during a 3-year follow-up. *J Am Geriatr Soc* 2000; 48: 1424-1429.
- 14) Sheikh JI, Yesavage JA. Recent evidence and development of a shorter version. In: Brink TL, ed. *Clinical Gerontology: a Guide to Assessment and Intervention*. New York: Haworth Press, 1986; 165-173.
- 15) Yesavage JA. Geriatric depression scale. *Psychopharmacol Bull* 1988; 24: 709-771.
- 16) Toba K, Okochi J, Takahashi T et al. Development of a portable fall risk index for elderly living in the community. *Jpn J Geriatr* 2005; 42: 346-352.
- 17) Wada T, Ishimoto Y, Hirosaki M et al. Twenty-one-item fall risk index predicts falls in community-dwelling Japanese elderly. *J Am Geriatr Soc* 2009; 57 (12): 2369-2371.
- 18) Matsubayashi K, Okumiya K, Osaki Y et al.

- Quality of life of old people living in the community. *Lancet* 1997; 350: 1521-1522.
- 19) Dias, J.C.P., Silveira, A.C., Schofield, C.J. The impact of Chagas disease control in Latin America - A review. *Memorias do Instituto Oswaldo Cruz*. 2002 July; 97(5): 603-612.
 - 20) Okumiya K, Sakamoto R, Matsubayashi K et al. Strong association between polycythemia and glucose intolerance in older adults living at high altitudes in the Andes. *J Am Geriatr Soc*. 2011 Oct;59(10):1971-3.
 - 21) Carey, J.W. Distribution of Culture-Bound Illnesses in the Southern Peruvian Andes. *Medical Anthropology Quarterly (New Series)* 1993; 7 (3). 281-300.