

<Original Article>

The relationship between the received number of health examinations and malnutrition among community dwelling elderly

Motoko Miyake¹⁾, Yukie Yoshida²⁾, Yukiko Ogawa²⁾ and Masahide Imaki²⁾

Summary The aim of this study was to clarify the relationship between the received number of health examinations and serum albumin concentration as a marker of malnutrition among community-dwelling elderly aged 65 and older.

Study subjects were 36,674 who had received a basic health examination at least one time from 2001 to 2007 in Habikino-city, Osaka.

The difference of mean serum albumin level with the received number of health examinations was calculated. 4.13 g/dl for men and 4.20 g/dl for women showed those who had a health examination only one time in seven years, whereas 4.22 g/dl for men and 4.24 g/dl for women who had had a health examination every year.

The findings of this study suggested that regularly receiving basic health examination may alter health behavior to prevent malnutrition among community dwelling elderly.

Key words: Health examination, Malnutrition, Serum albumin, Elderly, Health behavior

1. Introduction

As greater longevity has led to an increase in the elderly population, a significant consideration in preventive health services for the elderly is what constitutes healthy behavior for independent elderly living in community, specifically, how to prevent frailty and to increase the "years of healthy life".

Kumagai states that poor nutritional status for

elderly accelerates the decline in physical function with aging^{1,2)}. Malnutrition has usually been defined as a serum albumin level less than 3.5 g/dl, a condition also known as protein-energy malnutrition (PEM). Previous epidemiological studies have shown that decreasing serum albumin level affected decline of daily living function and increasing mortality among elderly³⁻¹¹⁾.

Even among healthy elderly people with a serum

¹⁾Graduate School of Comprehensive Rehabilitation, Osaka Prefecture University

²⁾Faculty of Graduate School of Comprehensive Rehabilitation, Osaka Prefecture University

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Corresponding Author: Motoko Miyake

Graduate students, Graduate School of Comprehensive Rehabilitation, Osaka Prefecture University,

3-7-30 Habikino, Habikino-city, Osaka 583-8555, Japan

albumin level greater than 3.5 g/dl, decreasing serum albumin level was a reliable predictor of poor outcomes, such as higher mortality^{3,8)}, cardiovascular disease^{9,10)}, and future functional decline¹¹⁾. Moreover, decreasing serum albumin level within normal range among healthy elderly people was associated with decline in muscle mass^{12,13)} and muscle strength¹⁴⁾ with aging, which is called "Sarcopenia", resulting in impaired mobility and balance among elderly people.

These investigations have suggested that decreasing serum albumin concentration among community-dwelling elderly may be a sign of future frailty and may result in the need for future care. Therefore prevention of malnutrition for community dwelling elderly is a significant concern in preventing frailty and other conditions requiring future care.

In this regard, previous study has shown that participation in a health examination affected the maintenance of good health status and reduced mortality risk¹⁵⁻¹⁶⁾. Chiou and Chang examined the effects of health examination on health maintenance for elderly in Taiwan by a five-year longitudinal study¹⁷⁾. Maeda et al. showed the relationship between participation in a health examination and mortality among community dwelling elderly¹⁸⁾. These findings suggest that regular participation in a health examination can prevent frailty related with malnutrition.

However, to date, no direct comparison has been made of the relationship between participation in a health examination and serum albumin concentration as a maker of malnutrition among community-dwelling elderly.

This study was conducted to examine the relationship between the received number of health examinations and serum albumin concentration as a marker of malnutrition in community-dwelling independent elderly aged 65 and older.

2. Materials and methods

1) Study subjects

The data were collected in Habikino City, which has a population of 118,695 and a 65-year-old and over population of 22,825 in 2005. The sample for this study comprised community-dwelling elderly aged

65 and older who had participated in a health examination organized by Habikino City.

The total number of participants in a health examination within the seven years from 2001 to 2007 was 41,367 (14,611 men and 26,756 women). 2,153 men and 2,540 women were excluded for uncertain liver diseases assessed by applicable GOT \geq 36 or GPT \geq 39 values because albumin is a protein synthesized in the liver.

The total number of study subjects was 36,674 (12,458 men and 24,216 women); 3,742 persons in 2001, 4,617 persons in 2002, 5,622 persons in 2003, 5,183 persons in 2004, 5,286 persons in 2005, 5,835 persons in 2006 and 6,389 persons in 2007. These subjects included those who had had a health examination more than one time in seven years.

Subjects who received a health examination in 2007 were followed retrospectively to determine how many times they received a health examination previously. Subjects younger than aged 64 in 2001 were eliminated from this analysis. Total number of subjects for analysis was 1,177 men and 2,420 women.

The protocol of this study was approved by the Institutional Review Board of Osaka Prefecture University. All the data were compiled by the health center of Habikino City, which allowed Osaka Prefecture University to use these data for analysis in this study.

2) Serum albumin

Blood samples were collected by medical practitioners in Habikino City. Each medical doctor sent it to different laboratories to analyze blood count and biochemical parameters. Serum albumin concentrations were determined with the Bromocresol Green (BCG) Procedure at different medical laboratories.

3) Statistical analysis

First, we determined the factor of serum albumin level by age and sex through cross-sectional analysis. Both the men's group and the women's group were divided into six age groups. Age group was 65-69, 70-74, 75-79, 80-84, 85-89, and more than 90 years old. For each age group by sex, 5, 50 and 95 percentile serum albumin values were calculated.

Second, we compared the difference of serum albumin value with how many times the subject participated in a health examination for seven years. As a baseline, those who had a health examination in 2007 were divided into seven groups by how many times they had received a health examination between 2001 and 2007.

ANCOVA (analysis of covariance) was conducted to demonstrate the relationship between the serum albumin levels and the received number of health examinations adjusted for age.

Data analysis was performed using the statistical package SPSS 13.0J for Windows.

3. Results

Figure 1 shows a comparison of the 5th, 50th and 95th percentile serum albumin level by age group and

sex. The 5th, 50th and 95th percentile serum albumin value showed a lower value with age. In particular, the 5th percentile albumin level by age 80 and over showed less than a 3.5 g/dl diagnosed level as PEM.

The difference in serum albumin level by the received number of health examinations was calculated by men (n=1,177) and women (n=2,420) as shown in Table 1.

Comparing the serum albumin level of those who had had health examination, those who had more frequent health examination were more likely to have a high level of serum concentration. Mean serum albumin adjusted for age was 4.22 g/dl for men and 4.24 g/dl for women who had the health examination every year for seven years. On the other hand, the serum albumin level of those who had the health examination only one time was significantly lower: 4.13 g/dl for men (p<0.001), and 4.20 g/dl for women

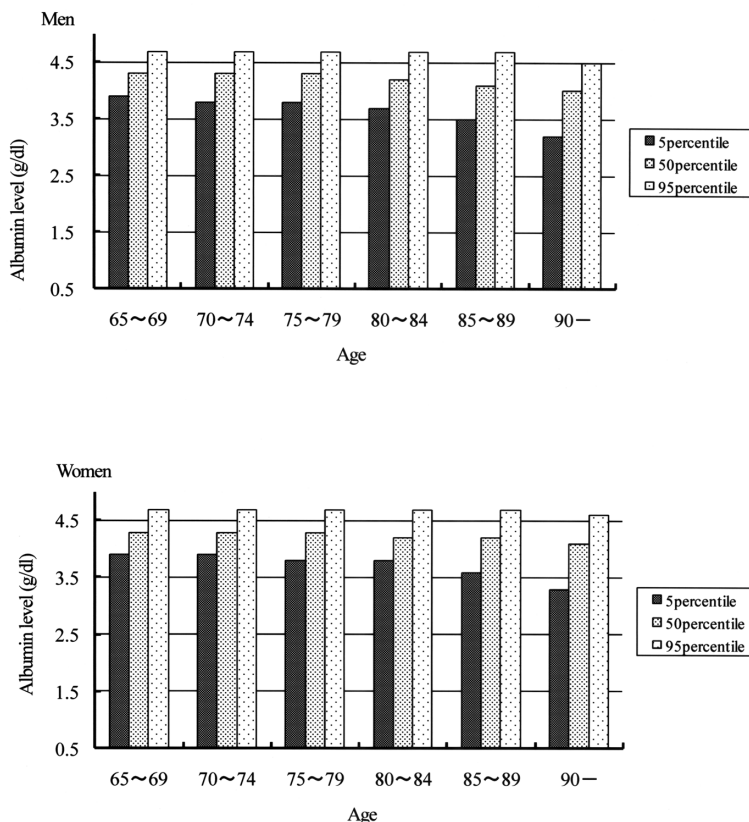


Fig 1 Five, fifty and ninety five percentile serum albumin level by age groups: men (above) and women (bottom). The 5th, 50th and 95th percentile serum albumin value showed a lower value with aging. Especially, the 5th percentile albumin level by age 80 and over showed less than a 3.5 g/dl diagnosed hypoalbuminemia.

($p < 0.001$).

($R^2 = 0.6809$).

The differences in serum albumin level by the received number of health examinations in the seven years are depicted graphically in Figure 2. The thick line in Figure 2 shows a similar increase in serum albumin level with the received number of health examination for men ($R^2 = 0.6524$) and women

4. Discussion

The present study analyzed differences in serum albumin level by age, sex, and the received number of health examinations by using basic health examination

Table 1 Comparing of serum albumin level (g/dl) by the received number of health examinations for seven years among elderly aged 65 and older participated in health examination in 2007

	Received numbers of HC for 7-y	Number of subject	Age (mean \pm SD)	Serum albumin level (g/dl)	
				(mean \pm SD)	Adjusted for age
Men	1	110	78.9 \pm 6.0	4.11 \pm 0.24	4.13
	2	119	77.4 \pm 5.2	4.15 \pm 0.23	4.16
	3	143	76.1 \pm 4.7	4.22 \pm 0.24	4.21
	4	174	76.5 \pm 5.0	4.23 \pm 0.24	4.22
	5	165	76.8 \pm 4.8	4.19 \pm 0.23	4.19
	6	170	77.0 \pm 4.9	4.23 \pm 0.23	4.26
	7	296	76.2 \pm 4.0	4.20 \pm 0.23	4.22
Women	1	186	78.8 \pm 6.6	4.19 \pm 0.24	4.20
	2	200	78.1 \pm 5.8	4.21 \pm 0.25	4.22
	3	250	77.4 \pm 5.7	4.20 \pm 0.25	4.20
	4	281	78.4 \pm 5.9	4.20 \pm 0.24	4.21
	5	335	77.5 \pm 5.6	4.21 \pm 0.25	4.22
	6	456	77.3 \pm 5.3	4.23 \pm 0.23	4.23
	7	712	76.3 \pm 4.8	4.26 \pm 0.24	4.24

HE: Health examination. Calculated using the analysis of covariance, adjusted for age in 2007.

***: $p < 0.001$. Subjects were eliminated aged below 65 years old in 2001

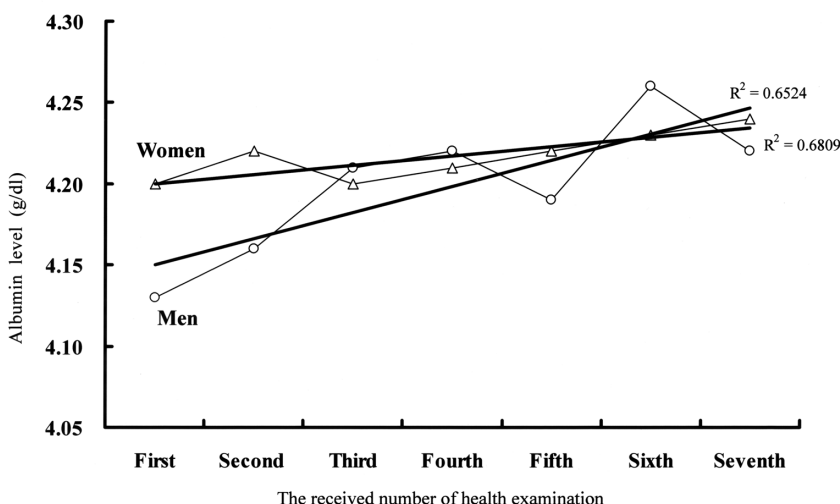


Fig. 2 The association of serum albumin level and the received number of health examinations for seven years. The thin line shows mean serum albumin level of men and women by difference in received number of health examinations for seven years. The thick line shows approximate line of men ($R^2 = 0.6524$) and of women ($R^2 = 0.6809$). Serum albumin level rises with received number of health examinations.

data for seven years among community dwelling elderly.

As differences of percentile serum albumin level by six age groups, older age groups showed lower albumin level than younger groups. Specifically, the 5th percentile serum albumin level for 90 years old and over showed a 3.5 g/dl diagnosed level as PEM. This result suggests that aging may affect decreasing serum albumin level.

Previous study demonstrated that nutritional status was a key factor affecting the decline in physical function with aging^{1,2}.

Another aging study stated that community-dwelling elderly who have had risks of malnutrition, less than 3.5 g/dl of serum albumin level, have not shown greater frequency of diagnosed diseases; however, they have shown more problems in daily living, such as decreasing physical fitness, physical function, and oral function¹⁹

Therefore, preventing malnutrition among community-dwelling elderly may help to maintain good health condition and physical function.

The results in this study show that men and women who have more had health examination showed a higher serum albumin level than those who have had fewer health examination. This finding strongly suggests that taking a basic health examination may help prevent decreasing serum albumin level. Moreover, this result leads us to believe that participation in a health examination repeatedly is a form of health behavior that may prevent malnutrition among the elderly.

Previous study suggested that health examination were related to maintaining health for the elderly⁵⁻¹⁸. Those who had an annual health examination showed lower mortality than those who had not it. Nakanishi examined the relationship between survival rate and health services using data of health management history, health status, and disability score by interview survey. This study suggested that an annual health examination has been a possible promoter of better health and reduced mortality among elderly people¹⁶.

Along with these previous studies, the results of the present study may suggest that receiving an annual

health examination could be an appropriate health behavior in maintaining better nutritional status for the prevention of malnutrition.

This study was a large cohort study assessing participants in a health examination at least one time for seven years, which included half of the elderly population living in the city. The subjects in this study were independent elderly people living in community.

Therefore, the results of the present study provide more reliable information suggesting that the continuous taking of basic health examination may be an efficient behavior in preventing age-related frailty among community-dwelling elderly.

Two limitations of the study are as follows. First, the relationship between serum albumin concentration and dietary habits was not analyzed in this study. Therefore, a future study should consider dietary habits by questionnaire or interview.

Second, data in this study were compiled from Japanese elderly living in Habikino City, which is a suburb of Osaka. Data for a future study could be compiled from different areas, such as a city or rural area. Life style, especially nutrition status or eating habits can be differentiated by generation, culture, and ethnicity.

In conclusion, this study demonstrates that receiving annual health examination is a behavior that helps prevent malnutrition for elderly people.

We believe that the prevention of malnutrition among community dwelling elderly helps to prevent frailty and maintain good health for elderly people.

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References

- 1) Kumagai S: Changes in nutritional status and screening among community dwelling elderly [Jpn]. *Clin Nutri*, 104: 762-768, 2004.
- 2) Kumagai S: Nutrition improvement methods among community dwelling elderly [Jpn]. *Geriat Med*, 48: 917-921, 2010.
- 3) Fried LP, Kronmal RA, Newman AB, Bild DE, Mittelman MB, Polak JF, et al: Risk factors for 5-

- year mortality in older adults. *JAMA*, 279: 585-592, 1998.
- 4) Klonoff-Cohen H, Barrett-Connor EL, Edelstein S: Albumin levels as a predictor of mortality in the healthy elderly. *J Clin Epidemiol*, 45: 207-212, 1992.
 - 5) Hasuo Y, Ueda K, Fujii I, Yanai T, et al: Changes in blood chemical constituents and death in the aged population. The Hisayama study [Jpn]. *Jpn J Geriat*, 23: 65-72, 1986.
 - 6) Nagai H, Shichita K, Haga H, Suyama Y, et al: Relationship of albumin concentration to aging and survivorship in the community volunteers aged 70 [Jpn]. *Jpn J Geriat*, 21: 588-592, 1984.
 - 7) Goldwasser P, Feldman J: Association of albumin and mortality risk. *J Clin Epidemiol*, 50: 693-703, 1997.
 - 8) Corti MC, Guralnik JM, Salive ME, Sorokin JD: Albumin level and physical disability as predictors of mortality in older persons. *JAMA*, 272: 1036-1042, 1994.
 - 9) Corti MC, Salive ME, Guralnik JM: Albumin and physical function as predictor of coronary heart disease mortality and incidence in older persons. *J Clin Epidemiol*, 49: 519-526, 1996.
 - 10) Schalk BWM, Visser M, Bremmer MA, Penninx BWJH, Bouter LM, Deeg DJH: Change of albumin and risk of cardiovascular disease and all-cause mortality: Longitudinal aging study Amsterdam. *Am J Epidemiol*, 164: 969-977, 2006.
 - 11) Schalk BWM, Visser M, Deeg DJH, Bouter LM: Lower levels of albumin and total cholesterol and future decline in functional performance in older persons: The Longitudinal aging study Amsterdam. *Age Ageing*, 33: 266-272, 2004.
 - 12) Visser M, Krtchevsky SB, Newman AB, Goodpaster BH, Tyllavsky FA, Nevitt MC, Harris TB: Lower albumin concentration and change in muscle mass: the health, aging and body composition study. *Am J Clin Nutr*, 82: 531-537, 2005.
 - 13) Baumgartner RN, Koehler KM, Romeo L, Garry PJ: Albumin is associated with skeletal muscle in elderly men and women. *Am J Clin Nutr*, 64: 552-558, 1996.
 - 14) Schalk, BWM, Deeg DJH, Penninx BWJH, Bouter LM, Visser M: Albumin and muscle strength: A longitudinal study in older men and women. *J Am Geriatr Soc*, 53: 1331-1338, 2005.
 - 15) Nakanishi N, Tatara K, Takashima Y, Fujiwara H, Takamori Y: The association of health management with the health of elderly people. *Age Ageing*, 24: 334-340, 1995.
 - 16) Nakanishi N, Tatara K, Tattatorige T, Murakami S, Shinsho F: Effects of preventive health services on survival of elderly living in a community in Osaka, Japan. *J Epidemiol Community Health*, 51: 199-204, 1997.
 - 17) Chiou CJ, Chang HY: Do the elderly benefit from annual physical examination? An example from Kaohsiung City, Taiwan. *Prev Med*, 35: 264-270, 2002.
 - 18) Maeda K, Yasuda N, Ohara H, Mino Y: Effects on mortality of getting the basic health examination under the health services for the elderly act and modification of the effects by health status among elderly persons in a rural community. *J Epidemiol*, 10: 22-28, 2000.
 - 19) Watanabe M: Preventive of malnutrition [Jpn]. *Clinical Nutrition*, 108: 497-504, 2006.