QOL Models Constructed for the Community-dwelling Elderly with *ikigai* (purpose in life) as a Composition Factor, and the Effect of Habitual Exercise

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Abstract The purpose of this study was to construct QOL models for the elderly that included *ikigai* as a composition factor and to clarify differences in two kinds of models, one constructed for the elderly with habitual exercise and the other for those without it.

The subjects were 1,566 healthy community-dwelling independent people aged 60 years or more (752 males, 814 females). First, the ratio of subjects with *ikigai* was calculated. The ratios of subjects with different kinds of objects of *ikigai* were also calculated. Next, structural equation models (SEM) were constructed on the basis of social, physical, and mental QOL and *ikigai*. Fits of the models were evaluated. To examine whether the presence or absence of habitual exercise caused any difference in the QOL model, subjects were divided into 4 groups according to whether they were male or female and whether they had or did not have an exercise habit. Multi-population group simultaneous analysis was then performed among the four groups.

More than 85% of the subjects had objects of *ikigai*. *Ikigai* is an important factor for comprehending the QOL of the elderly. It was possible to construct QOL models for the elderly with *ikigai* as a composition factor. The effect of physical QOL on mental QOL was negligible in females irrespective of whether they had an exercise habit. The effect of social QOL on mental QOL was profound in aged females with an exercise habit. The effect of the living situation on mental QOL was profound in aged females without an exercise habit. The effect of mental QOL on *ikigai* was more marked in subjects without an exercise habit than in those with an exercise habit. *J Physiol Anthropol Appl Human Sci 24(5): 525–533, 2005* http://www.jstage.jst.go.jp/browse/jpa [DOI: 10.2114/jpa.24.525]

Keywords: purpose in life, habitually exercising elderly, QOL model, SEM

Introduction

Quality of life (QOL), a concept that allows us to comprehend the various aspects of individuals totally and offers a viewpoint that emphasizes psychological aspects, is important in understanding "Successful Aging" (Hoshino, 1996). Until the present, it was thought to be particularly important to evaluate the QOL of the elderly from emotional or mental aspects measuring "happy aging". These aspects are generally called "subjective happiness" and are evaluated from viewpoints such as life satisfaction, morale, happiness, etc. (Hoshino, 1996).

WHOQOL (WHO, 1996) developed as an index to evaluate QOL, synthetically consists of four concepts: mental domain, physical domain, social relationships, and the environment. In Japan, Shibata (1998) has proposed a theoretical QOL model, which consists of the same four domains as WHOQOL. In this model, mental QOL has the highest rank, and lower in ranking, secondary factor structures where the physical, social, and living situations are located, are assumed (Shibata,1998). Shibata pointed out that it is important to recognize that the elderly have social roles and insisted that the QOL of the elderly should be evaluated with consideration of *ikigai* (*Ikigai* is explained below.)

Ikigai may be an element of QOL peculiar to Japan. There is no word with identical meaning in European countries or in the United States (Shibata, 1998). Shibata (1998) defined *ikigai* as "the consciousness or feeling of achievement obtained by a person when he or she is doing something useful for someone else or for society". (Other researchers defined *ikigai* differently. For instance, Maeda et al. (1979) defined *ikigai* as a subjective happy feeling.)

The contribution of physical aspects to raising the QOL level of the elderly is recognized. Fujita (1989) reported that self-evaluation of health contributed most markedly to raising and maintaining the QOL level, followed by social activities and the ability to carry out ADL. According to a review by Larson (1978), feelings of health greatly influence subjective

happiness. Recently, it was reported that exercise contributes to improvement in QOL greatly in elderly people who suffered from illness especially, an illness such as cancer (ACSM, 2004; Matsushita and Matsushima, 2004; Galvao and Newton, 2005).

Thus, self-evaluation of health and ability to perform ADL, which are related to the physical aspect, may contribute most to raising the QOL level of the elderly.

However, the effect of exercise was not examined in the QOL model with *ikigai*. Even though self-evaluation of health and ADL favorably affect QOL, encouraging the elderly to exercise may be meaningless if exercise does not contribute to raising the QOL level. Therefore, to clarify the effect of exercise on the elderly, it is necessary to compare two groups, one with and the other without habitual exercise in the QOL model with *ikigai*.

With community-dwelling elderly people as subjects, this study aimed to examine whether the presence or absence of habitual exercise resulted in any difference in the QOL model of the elderly in addition to *ikigai*.

Methods

1. Subjects and survey method

The subjects were elderly people, mainly participants in local lifelong learning circles, which provide cultural and physical activities such as ceramic art and trim gymnastics. Whether they participated in the circles regularly or irregularly or whether they participated in social activities other than learning circles was not examined. The following six cities were selected for this study by purposive selection. Kushiro (Hokkaido), Akita (Akita prefecture), Mito (Ibaragi prefecture), Kanazawa (Ishikawa prefecture), Fukui (Fukui prefecture), Komaki (Aichi prefecture) and Gifu (Gifu prefecture). One to three hundred questionnaires were distributed to subjects in each city (total 1,900 questionnaires). An author who worked in a university in each city visited every subject, as the interviewer in charge of the city, and read off the questions and collected the questionnaires at the time of visit. Preceding an explanation of the survey, interviewers made it clear that subjects could refuse the interview and that such a refusal would not result in any disadvantage. We recovered 1,865 questionnaires. Among them, those with incorrectly completed face sheets (concerning gender, age, medical history, etc.) were excluded. We finally obtained 1,566 completed questionnaires from 752 males and 814 females

(effective recovery rate, 84%).

2. Survey

In view of the reports of Shibata (1998), the QOL of the elderly was assumed to consist of the following factors: mental QOL, physical QOL, social QOL, the living situation, and *ikigai*. The items that were used to evaluate each factor were as follows.

1) Mental QOL

The following scales were selected for assessment of mental QOL because we considered that their validity and reliability were guaranteed and they had been used frequently in the past.

1-a. Depression

The Self-rating Depression Scale (SDS) (Zung,1965) and The Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff,1977) have been used widely for assessment of depression. The CES-D, which has been used frequently for evaluation of the QOL of the elderly, was chosen for this study. In making up the questions for the questionnaire we referred to a version translated into Japanese by Yatomi et al. (1993). In this scale, the higher the score, the more severe the depression.

1-b. Satisfaction

The Life Satisfaction Index A (LSIA) was used to evaluate the degree of satisfaction with life (Adams, 1969). In the LSIA, the theoretical structure of five factors was shown, and the LSIA was used as an evaluation index on condition by the general factor (Wada, 1984). A higher score indicated a higher level of satisfaction.

1-c. Morale

The PGC morale scale was devised by Lawton (1975). For this study, we used the translated Japanese version (Koyano, 1984). Morale was a concept originally representing strength of spirit of soldiers on the battlefield or of employees in the workplace. Kutner introduced the concept into the study of aging for the first time (Koyano, 1984). The scale for each item was determined according to Koyano (1984). A high degree of morale was indicated by higher scores.

2) Physical QOL

The ADL questionnaire was used to assess ADL (Sato et al., 2000). Its validity and reliability are being examined. The scale has been used for physical screening and is considered to be useful to assess ADL in aged people who function at a relatively high level. The scale consists of 12 items. Subjects

Table 1   Sample size

		Age						Exercise experience		Total
		60–64	65–69	70–74	75–79	80–84	85–	Habitual exercise	Without habitual exercise	
Gender	Male	133	208	222	115	54	20	228	524	752
	Female	167	219	196	136	56	40	203	611	814
Total		288	427	418	251	110	47	431	1135	1566

were requested to select one from among three options for each question. Scoring depended on predetermined rules (Sato et al., 2000).

Questions concerning self-evaluation of physical fitness and health were as follows (numbers in parentheses indicate scores given to individual categories).

2-a. Self-evaluation of physical fitness

[Inferior (1)], [Moderately inferior (2)], [Normal (3)]. [Moderately excellent (4)], and [Excellent (5)]

2-b. Self-evaluation of health

[Unhealthy (1)], [Not very healthy (2)], [Moderately healthy (3)], and [Very healthy (4)]

2-c. Regular visits to medical institutions

[Yes (1)] and [No (2)]

3) Social QOL

3-a. Frequency of physical exercises

[No physical exercise performed (0)], [Several times per year (1)], [1–2 times per month (2)], [2–3 times per week (3)], and [Almost everyday (4)]

3-b. Period during which exercise and/or sports had been routinely performed

[Less than half a year (1)], [More than half a year but less than one year (2)], [More than one year but less than 3 years (3)], [More than 3 years but less than 5 years (4)], and [More than 5 years (5)]

3-c. Participation in volunteer activities

[Almost everyday (1)], [2–3 times per week (2)], [1–2 times per month (3)], [Several times per year (4)], and [Do not participate (5)]

3-d. Number of close friends

[Many (1)], [Several (2)], [One (3)], and [No close friends (4)]

3-e. Going-out

[Almost every day (1)], [3–4 days per week (2)], [1–2 days per week (3)], and [Do not go out (4)]

3-f. Time frame for future plans

[More than 5 years (1)], [3 Years (2)], [One year (3)], [Half a year (4)], and [one month (5)]

In view of the definition of habitual exercise, we introduced a new variable "exercise experience" into this study. The value for "exercise experience" was obtained by multiplying the frequency of physical exercise by the period during which exercise and/or sports had been routinely performed.

4) Living situation

For assessment of the living situation, we selected items that had been included in the lifestyle survey based on a healthy routine (Breslow, 1977) but not included in the items for assessment of the three kinds of QOL described above. Since smoking and drinking activities showed marked deviation in reaction categories, they were excluded from analysis.

4-a. Economic condition

[Very satisfied (1)], [More or less satisfied (2)], [Not satisfied but not dissatisfied (3)], [Slightly dissatisfied (4)], and

[Dissatisfied (5)]

4-b. Sleep duration

[Able to sleep very well (1)], [Able to sleep reasonably well (2)], [Unable to sleep very well (3)], and [Unable to sleep at all well (4)]

4-c. Taking meals

[Regularly (1)], [More or less regularly (2)], [Not very regularly (3)], and [Irregularly (4)]

4-d. Smoking

[Non smoking (1)], [Somewhat (2)], [Average (3)], [Above average (4)], and [Heavy (5)]

4-e. Drinking

[A non-drinker (1)], [Seldom (2)], [Sometimes (3)], and [Almost everyday (4)]

5) Ikigai

To assess the presence or absence of *ikigai*, it is possible to use a psychological scale published previously, such as the Purpose in Life Test (PIL), Japanese version (PIL study group, 1993). In the present study, however, we devised the following question and categories in view of the ideas of Shibata (1998) and Maeda et al. (1979) and to minimize the subject's burden associated with filling out the questionnaire.

The question was "Do you have an *ikigai*?". The reaction categories were: a member of his or her family, friend, or relative (1), travel (2), social contribution or volunteer activity (3), hobby (4), business (5), and absence of an object of *ikigai* (6). Subjects were allowed to choose multiple options.

Scores 1–6 were converted to a dummy variable in such a way that subjects with an *ikigai* had a new score 1 and those without an *ikigai* had a new score 0.

3. Analyses

The ratio of subjects with *ikigai* was calculated and the ratios of subjects with different kinds of objects of *ikigai* were also calculated. In addition, values of the basic statistics were calculated for individual questionnaire items. Differences in mean values between groups with and without habitual exercise were examined by t-test.

Structural equation models (SEM) (Bollen, 1993) were constructed on the basis of social, physical, and mental QOLs and *ikigai*. Fits of the model were evaluated by the goodness of fit index (GFI, AGFI and RMSEA).

In order to examine whether the presence or absence of habitual exercise caused any difference in the QOL model, subjects were divided into 4 groups according to whether they were male or female and whether they had an exercise habit or not. The multi-population simultaneous analysis was then performed among the four groups. Upon performing the analysis, restrictions were set between the actual variable and the potential variable, and a difference between standardization coefficients was examined with regard to the relationship between potential variables. The significant level for statistical testing was 1%.

Table 2 Proportion of subjects with ikigai

	Male		Female	
	n	%	n	%
Without an object of ikigai	111	14.8	101	12.4
An object of ikigai	641	85.2	713	87.6
Total	752	100	814	100

Results

Table 2 shows the proportions of males and females with objects of *ikigai*. More than 85.6% of males and more than 87.4% of females had certain objects of *ikigai*.

Table 3 shows the values of basic statistics for individual items chosen as the framework of QOL, as well as results of significance tests of differences between groups with and without habitual exercise. In males, no significant differences were revealed between the two groups for age, regular visits to medical institutions, drinking, going-out, future plans, smoking, economic conditions, sleep duration, or regular meals. In females, no significant differences were revealed between the two groups for regular visits to medical institutions, CES, smoking, economic conditions, sleep duration, or regular meals ($p>=0.01$).

Figures 1 and 2 shows QOL models with values for the goodness of fit indices separately for the 4 groups of subjects divided according to gender as well as to the presence or absence of habitual exercise. Values of the GFI, AGFI, and RMSEA were 0.91, 0.88, and 0.04, respectively, in both groups. In order to show differences among the models more clearly, the significance of differences in the standardization coefficients (SC) between the groups were examined (Table 4).

In males, the standardization presumption value from the living situation to mental QOL, that from social QOL to mental QOL, and that from physical QOL to mental QOL were almost identical to each other irrespective of whether the subjects had an exercise habit. On the other hand, standardization presumption values obtained similarly were different from each other in females and showed the trend to be different depending upon the presence or absence of an exercise habit.

In females, no significant correlation was found between mental QOL and physical QOL (SC=0.05–0.08). The correlation between mental QOL and social QOL was highest in female with an exercise habit (SC=0.60). No significant differences were found between subjects with an exercise habit and without it both in males and in females (α=0.01). The influence of the living situation upon mental QOL was most pronounced in females without an exercise habit. Significant differences were noted only between mental QOL and *ikigai* both in males and females. The correlation between mental QOL and *ikigai* was more marked in subjects without an

exercise habit.

Discussion

In a preliminary study on 7,402 independent people aged 70 years or more (Honma, 1999), 86.4% of males and 87% of females were found to have *ikigai*. Aoki (1994) studied *ikigai* in the independent elderly using a Japanese version of the PIL test. He found that about 85% of males and females had *ikigai*, such as having a definite meaning or purpose in life. This value is comparable to that obtained in the present study. As proposed by Shibata, *ikigai* is an important element of the structural concept of the QOL of the elderly and should consequently be considered to be a dependent variable in the QOL model.

The meaning of *ikigai* for individuals changes depending on how they perceive *ikigai*. While taking *ikigai* as an exogenous variable, we therefore constructed mental QOL models on the basis of the QOL model of the elderly proposed by Shibata (1998) (Figs. 1 and 2). Values of the fit index exceeded a certain level in the models constructed in this study. This indicates that *ikigai* is one of the structural elements of the model, and consequently a factor related to the QOL of the elderly. The WHO defined QOL as "individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" (WHO, 1996). It seems to be appropriate consequently to take *ikigai* as a prediction variable in the QOL model of the elderly.

However, the contribution of the mental QOL, which was assumed to be a factor influencing *ikigai*, was not very pronounced in the present study. Consequently, it seems necessary to explore another factor more influential to *ikigai* or to construct another model. Results of a follow-up study for 36 months by Honma (1999) indicate that prolongation of activity expectancy and life expectancy depends upon the presence of *ikigai* and daily activities to encourage health. It is obvious that the presence of ikigai has a favorable effect on daily activity and life expectancy. In view of the results of the present study, it seems not only necessary to examine the effect of *ikigai* on raising mental QOL but also to examine the direct effects of health behavior and daily life on *ikigai*.

Values of the basic statistics were examined statistically between subjects with and without an exercise habit for each item of QOL. Significant differences were found between the two groups for many items comprising physical, mental, and social QOL, whereas no significant differences were found for items comprising the living situation. These results indicate that although an exercise habit has no significant effect on the living situation, it has some effect on QOL.

Results of numerous epidemiological studies have indicated that, irrespective of age, high levels of physical activity are important to maintain high levels of physical fitness and to establish a desirable life style (Tanaka and Lee, 1996). The results of our study also indicate that an exercise habit is

Table 3 Values of the basic statistics for individual items chosen as the framework of QOL and results of significance tests of differences between groups with and without habitual exercise

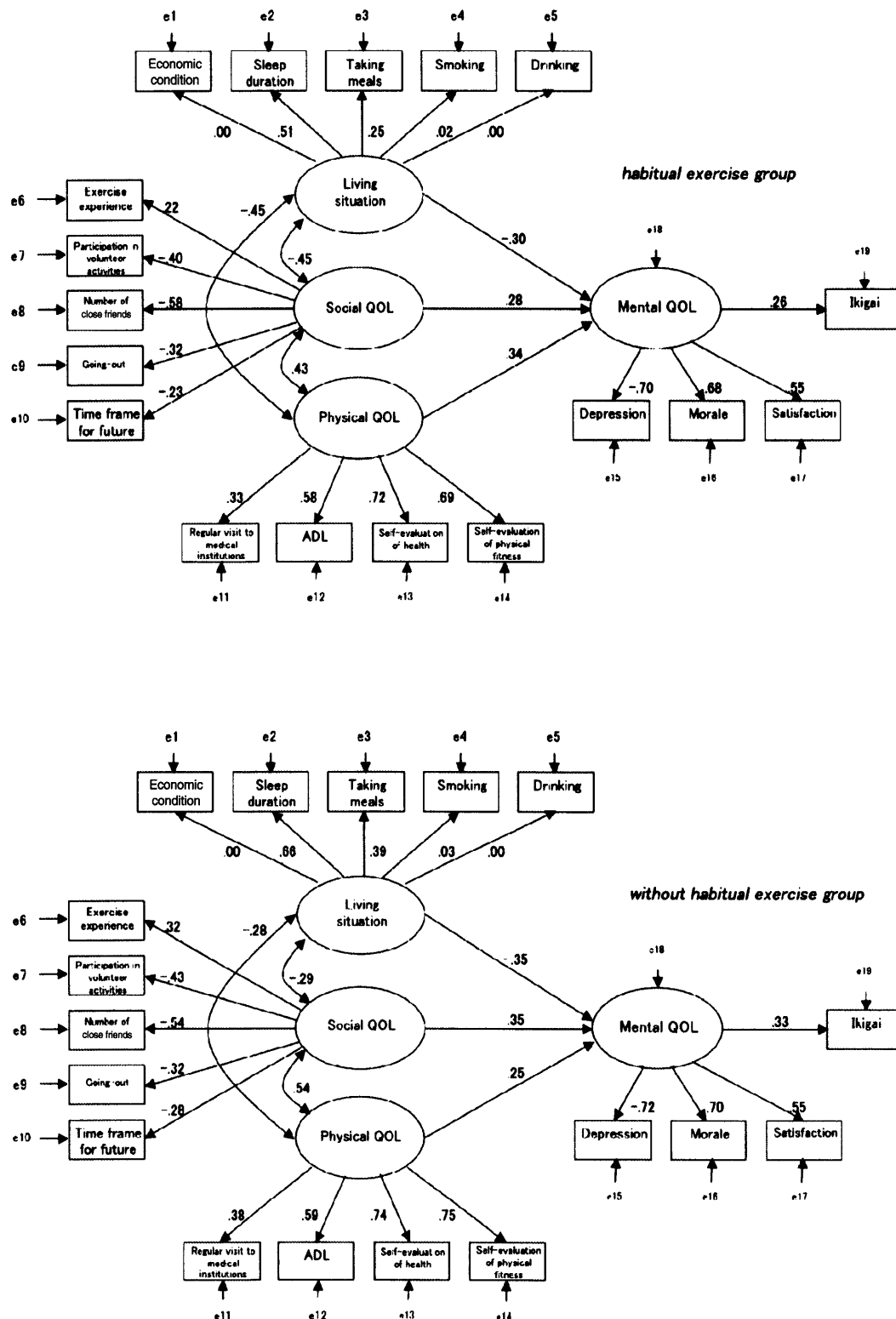| | Male (n=752) | | | | | | Female (n=814) | | | | | |
| | Habitual exercise | | Without habitual exercise | | t-value | P-value | Habitual exercise | | Without habitual exercise | | t-value | P-value |
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
Age	70.96	6.56	70.50	5.75	0.928	0.354	71.47	7.22	69.02	6.27	4.29	0.000
Regular visit to medical institutions	1.36	0.44	1.35	0.44	0.290	0.772	1.28	0.40	1.35	0.44	-2.09	0.037
Self-evaluation of physical fitness	2.95	0.83	3.35	0.83	-6.029	0.000	2.77	0.82	3.16	0.62	-6.22	0.000
Self-evaluation of health	2.76	0.68	2.93	0.61	-3.151	0.002	2.71	0.65	2.99	0.48	-5.52	0.000
Drinking	2.32	1.23	2.17	1.15	1.623	0.105	3.39	0.88	3.15	1.00	3.20	0.001
Going-out situation	2.13	1.02	1.93	0.89	2.583	0.010	2.26	1.01	1.73	0.75	6.92	0.000
Future plan	2.17	1.06	1.97	1.12	2.357	0.019	2.32	1.07	2.00	1.13	3.66	0.000
Number of close friends	2.08	0.92	1.85	0.77	3.385	0.001	1.90	0.78	1.62	0.60	4.81	0.000
ADL	28.59	4.84	30.95	4.10	-6.421	0.000	26.06	5.12	29.27	3.70	-8.26	0.000
Morale (PGC morale scale)	11.58	2.98	12.37	2.88	-3.368	0.001	11.03	3.29	11.96	2.88	-3.60	0.000
Depression (CES-D)	9.81	4.18	8.89	4.07	2.804	0.005	10.14	3.79	9.80	4.35	1.08	0.281
Satisfaction (LSIA)	9.73	3.33	10.94	3.29	-4.580	0.000	9.35	3.03	10.23	2.91	-3.62	0.000
Smoking	1.63	0.47	1.70	0.45	-1.904	0.057	1.92	0.20	1.92	0.19	0.15	0.883
Participation in volunteer activities	2.16	0.77	1.89	0.73	4.612	0.000	2.35	0.74	2.02	0.76	5.54	0.000
Economic condition	2.36	0.91	2.25	0.90	1.437	0.151	2.29	0.92	2.13	0.83	2.14	0.032
Sleep duration	2.15	0.60	2.09	0.52	1.284	0.199	2.15	0.63	2.12	0.63	0.68	0.497
Taking meals	1.74	0.59	1.69	0.62	0.978	0.328	1.65	0.58	1.63	0.59	0.52	0.602
Ikigai	0.81	0.39	0.94	0.23	-4.680	0.000	0.85	0.35	0.95	0.23	-3.51	0.000
Frequency of physical exercises	1.28	2.87	15.75	3.72	-57.892	0.000	0.82	2.23	13.95	3.25	-64.23	0.000

Fig. 1   Factor structure of QOL model of male.

effective in improving QOL, as has been pointed out repeatedly in general.

The effects of the living situation, social QOL, and physical QOL on mental QOL were not markedly different between two groups of males, one performing and the other not performing habitual exercise. These three factors seem consequently to be correlated with mental QOL in a similar way. In contrast, the living situation and social QOL had quantitatively different effects on mental QOL in females, depending upon whether they had habitual exercise, while physical QOL had negligible effects on mental QOL irrespective of an exercise habit. The last finding suggests that improvement of physical QOL does not necessarily lead to improvement of mental QOL in females.
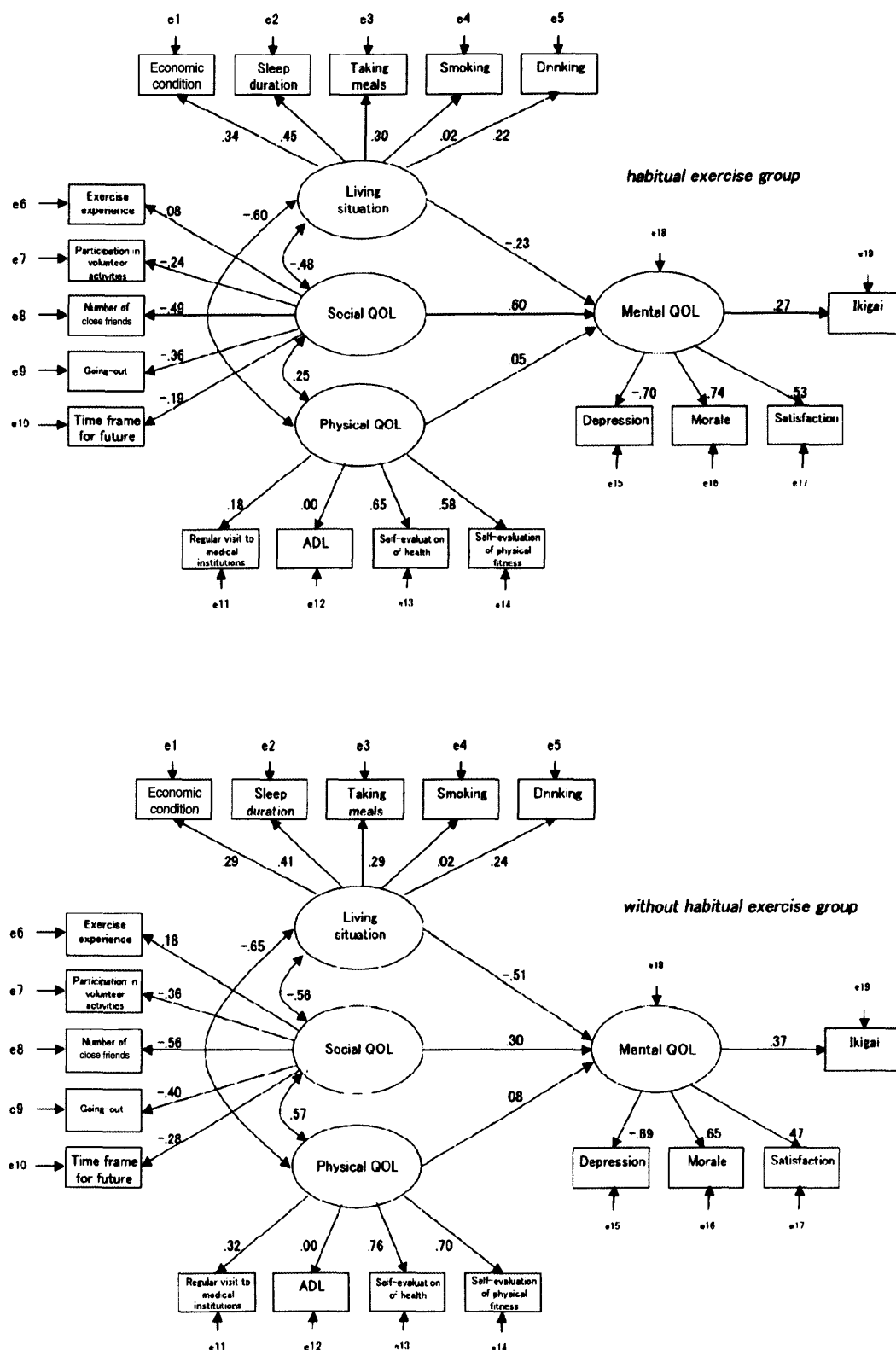
Fig. 2   Factor structure of QOL model of female.

The correlation (SC) of mental QOL with social QOL had significant value (0.30–0.60) in females with and without habitual exercise. The effect of physical QOL on mental QOL was negligible in females with an exercise habit. However, social QOL was found to influence mental QOL moderately in the group. An exercise habit consequently seems to have a beneficial effect on mental QOL in females through development of social QOL during participation in physical activities rather than through improvement of physical ability itself.

The importance of a social network to the elderly has long been pointed out (Masuchi and Kishi, 2001). Social support, an example of which is support by close friends, was reported to ameliorate mental stress (Masuchi and Kishi, 2001). The

Table 4   Significance of differences in the standardization presumption value between exercise groups

	Male		Female	
	Habitual exercise	Without habitual exercise	Habitual exercise	Without habitual exercise
Mental QOL <-- Physical QOL	0.34	0.25	0.05	0.08
Mental QOL <-- Social QOL	0.28	0.35	0.60	0.30
Mental QOL <-- Living situation	−0.30	−0.35	−0.23	−0.51
Ikigai <-- Mental QOL	0.26	<0.33**	0.27	<0.37**

Values are standardization coefficients
** $p<0.01$

results of the present study suggest that social QOL has a powerful effect on mental QOL in females with an exercise habit, and that the exercise habit should be assumed to be a factor of social QOL.

Since a close relationship was previously found between self-evaluation of health and the degree of satisfaction (Ishihara et al., 1989), it has been thought that physical QOL regulates and modulates mental QOL. On the other hand, Sidney and Shephard (1977) reported that although athletic training led to improvement of health, it had no effect on the degree of satisfaction. In view of the findings of the present study, these apparently contradictory results may be explained by the assumption that physical QOL and habitual exercise influence mental QOL not directly, but indirectly through a third factor.

The living situation influenced mental QOL most profoundly in females with no exercise habit. In these females, mental QOL is considered to depend mostly on the basic living situation. Since the amount of social support is closely correlated to the degree of satisfaction (Kim et al., 1999), the effort to maintain basic activities of daily life seems to contribute much to ikigai and mental QOL in aged females with no exercise habit, who probably have scanty social support.

In males as well as in females, subjects with an exercise habit differed from those without the habit only in the relationship between mental QOL and ikigai. In both genders, habitual exercise modifies the extent to which mental QOL influences ikigai, and mental QOL contributes more profoundly to ikigai in subjects without an exercise habit than in those with the habit. Based on the above findings, it is conceivable therefore that an exercise habit in the aged benefits ikigai directly and indirectly.

Conclusions

This study was made to construct QOL models for the elderly that included ikigai as a composition factor and also to clarify differences in two kinds of models, one constructed for the elderly with habitual exercise and the other for those without it.

The main results were as follows:

1.   Ikigai is an important factor in order to comprehend the QOL of the elderly.

2.   It was possible to construct QOL models for the elderly with ikigai as a composition factor.

3.   The effect of physical QOL on mental QOL was negligible in females irrespective of whether they had an exercise habit.

4.   The effect of social QOL on mental QOL was profound in aged females with an exercise habit.

5.   The effect of the living situation on mental QOL was profound in aged females without an exercise habit.

6.   The effect of mental QOL on ikigai was more marked in subjects without an exercise habit than in those with an exercise habit.

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