재활치료과학 제 10 권 제 2 호
Therapeutic Science for Rehabilitation
Vol. 10. No. 2. 2021.
https://doi.org/10.22683/tsnr.2021.10.2.075

Predicting Healthy Lifestyle Patterns in Older Community Dwelling Adults: A Latent Profile Analysis

Park, Kang-Hyun[*], M.S., O.T., Yang, Min Ah[**], Ph.D., O.T.,
Won, Kyung-A[***], M.S., O.T., Park, Ji-Hyuk[****], Ph.D., O.T.

[*]Dept. of Occupational Therapy, Kangwon National University, Lecturer
[**]Osan Dementia Center, Occupational Therapist
[***]Incheon Metropolitan Dementia Center, Occupational Therapist
[****]Dept. of Occupational Therapy, College of Software Digital Healthcare Convergence, Yonsei University, Professor

국문초록

Objective : The aim of this study was to identify subgroups of older adults with respect to their lifestyle patterns and examine the characteristics of each subgroup in order to provide a basic evidence for improving the health and quality of life.

Methods : This cross-sectional study was conducted in South Korea. Community-dwelling older adults (n=184) above the age of 65 years were surveyed from April 2019 to May 2019. This study used latent profile analysis to examine the subgroups. Chi-squared (χ^2) and multinomial logistic regression measures were then used to analyze individual characteristics and influencing factors.

Results : The pattern of physical activity which is one of the lifestyle domains in elderly was categorized into three types: 'passive exercise type (31.1%)', 'low intensity exercise type (54.5%)', and 'balanced exercise type(14.5%)'. Activity participation was divided into three patterns: 'inactive type (12%)', 'self-management type (61%)', and 'balanced activity participation type (27%)'. In terms of nutrition, there were only two groups: 'overall malnutrition type (13.5%)' and 'balanced nutrition type (86.5%)'. Furthermore, as a result of the multinomial logistic regression analysis to understand the effects of lifestyle types on the health and quality of life of the elderly, it was confirmed that the health and quality of life were higher in those following an active and balanced lifestyle. In addition, gender, education level and residential area were analyzed as predictive factors.

Conclusion : The health and quality of life of the elderly can be improved when they have balanced lifestyle. Therefore, an empirical and policy intervention strategy should be developed and implemented to enhance the health and quality of life of the elderly.

Keywords : Health, Healthy lifestyle, Latent profile analysis, Older adults, Quality of life

교신저자 : 박지혁(otscientist@yonsei.ac.kr)
|| 접수일: 2021.01.13 || 심사일: 2021.01.25
|| 게재승인일: 2021.03.03

Ⅰ. Introduction

One of the issues facing the modern world is the problem of a rapidly growing elderly population. Due to the growth of elderly populations in many countries, the health of the elderly is becoming an increasingly major health concern for governments (Wang, Lee, & Hwang, 2019). For this reason, various policies and services aimed at improving the quality of life of the elderly are being presented and introduced – such as the provision of basic pensions, expanding employment opportunities for the elderly, and enforcing the act on long-term medical care for the elderly (Ji, Seok, Sin, Jung, & Kim, 2010; Kang, 2017). Although various proposals have been made, there is a need to discuss whether these policies manifest, after having analyzed the needs of the elderly (Jeon, 2017). Recently, there have been many cases in which research has only been conducted for research purposes. From this perspective, it is essential to analyze the lifestyles of the elderly and to know elderly in order to address a variety of issues related to policies concerning their welfare. Lifestyle is a composite of factors – such as the habits of life, values, and the character of people – which has subjective meaning and is an important factor affecting the overall behavior of an elderly (Engel, Blackwell, & Kollat, 1982; Park, Han, Park, Ha, & Park, 2019). These factors can be said to compose aspects of an individuals' lifestyle, and are closely related to the health and quality of life of the elderly (Clark et al., 2012; World Health Organization, 2015). In other words, lifestyle can be an important variable that can be measured – as started by Neugarton (1968) and Bartos (1980), and which began taking place in Korea in the 1990s.

However, as the number of older individuals with greater access to financial resources continues to grow, the needs of elderly people are becoming increasingly diverse. Therefore, research on the lifestyles of elderly people needs to be carried out continuously so as to account for changing social contexts (Jeon, 2017). According to a study (Jeon, 2016), research on lifestyles of the elderly was concentrated between the years of 2010 and 2012, but related research has waned since. In addition, it has been found that the areas of research concerning lifestyles of the elderly are limited to tourism, social welfare, medical welfare, and physical education (Jeon, 2016). Therefore, studies concerning lifestyles of the elderly needs to be conducted across various fields.

The World Health Organization (WHO) stresses that healthy lifestyles must be formed and maintained in order to improve one's health and quality of life, since lifestyle elements – such as physical activity and diet – affect an individual's health (WHO, 2000; WHO, 2015). It has been proposed that healthy lifestyles should be designed along ideals of participation in activities and that one should work to promote health in line with these trends (Roley et al., 2008). In other words, it is necessary to study activities and participation together as lifestyle elements, in addition to physical activities, nutrition, and sleep, in order to promote lifestyle research for the elderly in the future (Park, Won, & Park, 2019).

Occupational therapy is one of the healthcare areas aimed at the elderly. The ultimate goal of occupational therapy is to ensure that people who have lost their functions for any reason are able to engage in daily activities as independently as

possible, and to be able to actively participate in society in order to live a happy life (Song, Jang, Jung, Hong, & Jang, 2013). In this way, occupational therapy is a field that places importance on activities and participation levels so as to improve health and the quality of life. The field of occupational therapy analyzes the effects of activities and participation on individuals' personal health (and upon other related variables). However, it has been reported that various aspects of health promotion-related activities are affected simultaneously, as opposed to by individual lifestyle elements (Moon, 2014). As such, it is necessary to comprehensively understand the characteristics of individual or group health promotion-related activities, as individual health conditions are not only affected by individual behavioral habits.

Therefore, efforts have been made to find health promoting behavioral patterns. However, there are limitations that exist, as such attempts have not included factors concerning the levels of activity and participation that would be important when describing recent health conditions. In this study, we examine the lifestyles of the elderly as a representative factor in affecting their health and their quality of life. Furthermore, we analyze the differences between the types of lifestyles led by older individuals, the characteristics of each group type, and the health and satisfaction of life by type. The primary aim of the study was to use LPA with three lifestyle factors as indicator to identify subgroups of older adults with different lifestyle patterns. Additionally, the second aim of the study was to examine the predictors of healthy lifestyle.

II. Methods

1. Participants and data collection

This research is based on the "Lifestyle Research Survey for Promoting the Health of the Elderly" research conducted by SSK (Social Science Korea) at Yonsei University in 2019. These materials were prepared in the form of questionnaires by researchers and research assistants who understand this research, visiting the community social welfare center, the university for senior citizens, and the senior center from April 2019 to May 2019. The inclusion criteria for the study included: (1) community-dwelling older adults aged over 65 years, (2) living in South Korea, and (3) fluent in Korean. There are no specific exclusion criteria. The sample of this study was 210 people from 6 representative areas, aged 65 or older in the community. A total of 184 people were selected for research and analyzed in this study, except for 16 people who have missing items. This study was carried out approval for ethical procedures from the Institutional Review Board (IRB) of Yonsei University Mirae Campus (101489-201911-SB-169-01).

2. Measurements

Physical activity, activity participation, and nutrition areas classified as components of the multifaceted lifestyle of the elderly were classified and each area was measured (Park et al., 2019; Park & Park, 2019). In order to assess the participants' lifestyle, we developed multi-faceted lifestyle questionnaire based on the previous literature review and research. The total number of the items

of the questionnaire are 18 items.

1) Lifestyle indicator 1 : Physical activity

Six of the sub-items present in the Simple Lifestyle Indicator Questionnaire (Godwin et al., 2008) were extracted and used in order to measure physical activity and participation. A 5-point Likert scale is used for measuring the degree of participation in physical activities, with scores ranging from "low intensity exercise", to "moderate intensity exercise", and "high intensity exercise". The higher the score, the higher the level of participation in physical activities. The data's internal consistency (Cronbach's alpha) of this study is a statistically significant 0.711.

2) Lifestyle indicator 2 : Activity participation

In order to measure whether subjects participate in a variety of activities, six items from the Korea National Health and Nutrition Examination Survey (KNHANES) (Ministry of Health and Welfare, 2017) relating to activity participation were extracted and used. These six items were assessed via a 5-point Likert scale, whereby a higher score indicates a higher frequency of participation in various activities. According to the analysis, Cronbach's alpha for this measure is 0.633 in this study.

3) Lifestyle indicator 3 : Nutrition

In order to measure whether the subjects have a balanced diet, six items were extracted for each nutrient - as per the categories of the Elderly Nutrition Index (Chung, Kwak, Kim, & Kang, 2018) - and the eating habits of the elderly were measured. Eating habits were measured on a 5-point Likert scale; the higher the score, the more balanced an individual's eating habits are. The analysis of this study showed an internal consistency (Cronbach's alpha) of 0.662.

4) Korean version of the World Health Organization Disability Assessment Schedule 2.0 (K-WHODAS)

The Korean version of the World Health Organization Disability Assessment Schedule 2.0 (K-WHODAS) was used to measure the overall health of the subjects. This assessment has a high degree of validity and reliability, consisting of a total of 12 questions that cover cognition, mobility, self-management, interaction, activities, and participation in life. Lower scores indicate a higher health level (Lee & Kim, 2011). The data for the overall health of the subjects display an internal consistency (Cronbach's alpha) of 0.815 in this study.

5) WHO Quality of Life-BREF (WHOQOL-BREF)

The WHO Quality of Life-BREF (WHOQOL-BREF) was used as a tool to measure individuals' quality of life. In the case of this evaluation, a higher score represents a higher quality of life (Min et al., 2002), and exhibits an internal consistency (Cronbach's alpha) of 0.867 in this study.

3. Data analysis

In this study, the LPA was conducted using Mplus 8.0. Furthermore, multiple regression analysis was conducted using IBM SPSS Statistics 25.0 in order to analyze the characteristics, health, and quality of life of the subjects.

LPA has the advantage of allowing for objective group classification of potential group derivation

(unlike in existing hierarchical group analysis) by targeting continuous variables, finding potential groups of individuals with similar characteristics, and providing statistical and diverse conformance indicators (Kim & Cho, 2018; Kim & Hong, 2010; Magidson & Vermunt, 2002). In addition, since it does not have to satisfy statistical preconditions – such as the regularity, linearity, and homogeneity of the material – it is possible to perform more objective and reliable analysis, given that the material is highly utilized (unlike in the existing cluster analysis) (Magidson & Vermunt, 2002). Furthermore, there is no need for the standardization of variables (Kang & Lee, 2014).

Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), and Sample-Size Adjusted BIC (SSABIC) are used as suitable indicators for estimating potential layers – as such, a lower number indicates a higher level of suitability of the model (Collins, Fidler, Wugalter, & Long, 1993; Nylund, Asparouhov, & Muthen, 2007). The entropy index refers to the average of the classification accuracy of each individual observed value; as such, the closer an observation is to 1.0, the more accurately it is classified into a particular group and is, subsequently, usually judged to be a good (Jedidi, Ramaswamy, & Desarbo, 1993). The statistical significance verification between k groups and k-1 groups in the LPA was done through Lo-Mendell-Rubin LRT and provides a level of significance in determining whether to support each model (Lo, Mendell, & Rubin, 2001).

In this study we classify types for physical activity, activity participation, and nutrition, and then use multinomial logistic regression to look at the differences between independent variables for those types. There were a total of 9 independent variables, with three dependent variables classified as passive exercise participation type, low intensity physical activity participation type, and balanced physical activity participation type for physical activity, inactive type, basic ADL participation type, and balanced activity participation type for activity participation, and overall malnutrition type, and balanced nutrition type for nutrition.

Ⅲ. Results

1. Characteristics of the study population

Table 1 presents the sample characteristics. The 184 participants consisted of mostly female (76.1%) older adults – where the mean age was 76.9 (SD=7.5) years. Of the participants, 87.0% had chronic diseases, and 29.3% indicated that they lived independently. In terms of education, 42.9% of participants indicated that they had a high level of education (high school education or college) and the majority of the participants (89.7%) were retired.

2. Latent Profile Analysis (LPA)

1) LPA of physical activity

In physical activity, the statistics derived from LPA suggest that a three-class model is favored as a result of the lowest fit indices and the high entropy value (Table 2). Figure 1 presents the three classes of physical activity, as identified using LPA. For further clarification, each class was assigned a summary label. Class 1 (31.1%) – *passive exercise participation type* – was comprised of respondents who reported

Table 1. General Characteristics (N=184)

Characteristics	Classification	*n*	(%)
Gender	Male	44	23.9
	Female	140	76.1
Age (year)	61~70	45	24.5
	71~80	78	42.4
	81~90	61	33.1
Medication	Yes	160	87.0
	No	24	13.0
Living together	Living alone	54	29.3
	Living others	130	70.7
Education (year)	Non	24	13.0
	Elementary (1-3)	6	3.3
	Elementary (1-6)	52	28.3
	Middle school	22	12.0
	High school	54	29.3
	Over college	25	13.6
	Missing	1	0.5
Retirement	Yes	165	89.7
	No	19	10.3
	Missing	14	7.6
Residence	Metropolis	114	61.9
	Medium & Small Cities	66	35.9
	Rural area	4	2.2

Table 2. A Comparison of the Fit Statistics of Different Latent Class Models in Physical Activity (N=184)

	Number of latent classes			
	Class 2	Class 3	Class 4	Class 5
AIC	3481.302	3360.323	3291.433	3235.560
BIC	3542.386	3443.911	3397.526	3364.157
Adjust BIC	3482.208	3361.563	3293.007	3237.467
Entropy	0.944	0.946	0.919	0.927
LMR	230.065	130.650*	80.679	76.207

*: $p<0.05$

AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; LMR=Lo-Mendell-Rubin

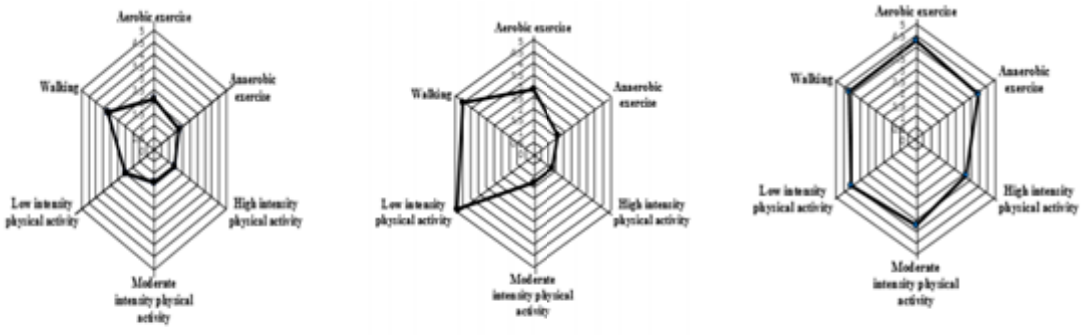

Figure 1. Radar Plots Comparing Three Classes Across Physical Activity Categories

Table 3. Class Membership and Item Response Probabilities of the Three Latent Classes (N=184)

Characteristics	Passive exercise participation type (31.1%)	Low intensity physical activity participation type (54.5%)	Balanced physical activity participation type (14.5%)
Mean score of item responses			
Aerobic exercise	2.092	2.825	4.278
Anaerobic exercise	1.738	1.605	3.918
High intensity physical activity	1.429	1.279	3.121
Moderate intensity physical activity	1.398	1.274	3.728
Low intensity physical activity	1.969	4.887	4.056
Walking	3.172	4.499	4.180

a low level of participation in all areas of aerobic exercise, anaerobic exercise, and in high, moderate, and low intensity physical activities (except for walking exercise). Class 2 (54.5%) – *low intensity physical activity participation type* – is characterized by respondents who reported a high level of participation in low intensity physical activity (mean=4.9) compared to other types of physical activity. Class 3 (14.5%) – *balanced physical activity participation type* – is composed of respondents who regularly participated in all six physical activities (Table 3).

2) LPA of activity participation

In order to identify potential types of activity participation patterns among older adults, the number of classes was increased from two to four. The final model of activity participation was derived considering the model fit statistics (Table 4). A three-class model was identified; these classes were labelled inactive type, basic ADL participation type, and balanced activity participation type. The inactive type includes respondents with a low level of participation across all six activities which are asked about in the survey questionnaire – such as

Table 4. A Comparison of the Fit Statistics of Different Latent Class Models in Activity Participation (N=184)

	Number of latent classes		
	Class 2	Class 3	Class 4
AIC	3278.696	3166.174	3124.624
BIC	3339.780	3249.763	3230.717
Adjust BIC	3279.602	3167.414	3126.198
Entropy	0.995	0.907	0.920
LMR	167.217**	123.148**	54.069

*: $p<0.05$, **: $p<0.01$
AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; LMR=Lo-Mendell-Rubin

Table 5. Class Membership and Item Response Probabilities of the Three Latent Classes (N=184)

Characteristics	Inactive type (12%)	Basic ADL participation type (61%)	Balanced activity participation type (27%)
Mean score of item responses			
Activity of daily living (ADL)	2.647	4.866	4.842
Instrumental activity of daily living (IADL)	2.494	3.655	4.213
Leisure activity	2.324	1.646	3.962
Social activity	2.047	2.174	3.706
Productive activity (paid work)	1.956	1.686	2.746
Education	1.639	1.487	2.531

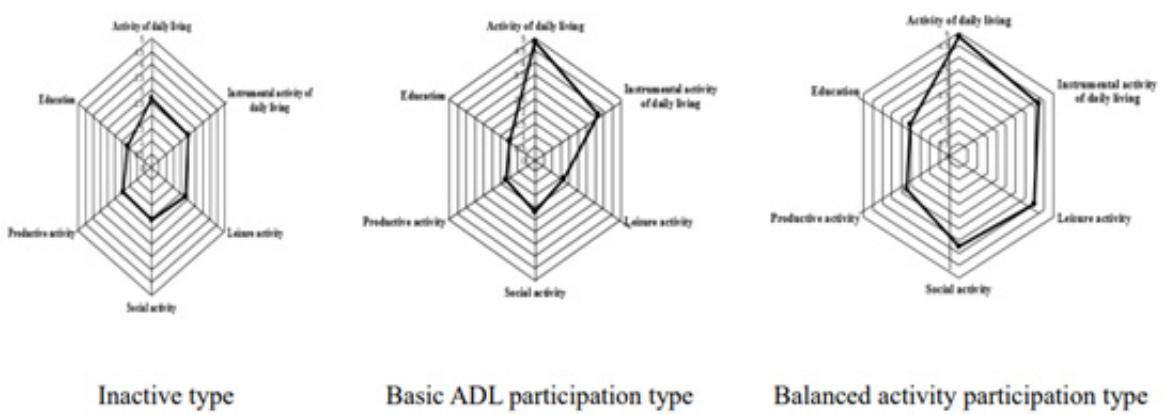

Figure 2. Radar Plots Comparing Three Classes of Activity Participation Patterns

activity of daily living (ADL), instrumental activity of daily living (IADL), leisure activity, social activity, productive activity (paid work), and education. The basic ADL participation type is populated by those with high levels of participation in only ADL activities. Lastly, the balanced activity participation type was composed of respondents who reported a high level of participation in overall activity, except work and education activities (Table 5). Figure 2 demonstrates the three distinct classes of activity participation in older adults.

3) LPA of nutrition

A two-class model represents the optimal balance of model fit and interpretability (Table 6). The final latent classes were *overall malnutrition type* and *balanced nutrition type*. The older adults in the *overall malnutrition type* demonstrated low levels of intake in all essential nutrients - such as minerals, vitamins, protein, and water. The balanced nutrition type, conversely, tended to consume proper nutrition in order to maintain their health; protein intake was particularly high (Table 7). Figure 3 shows the different classes of nutrition.

3. Predictors by potential type of physical activity

First, the multinomial logistic regression results of each type of physical activity are as follows.

Table 6. A Comparison of the Fit Statistics of Different Latent Class Models in Nutrition (N=184)

	Number of latent classes		
	Class 2	Class 3	Class 4
AIC	3297.159	3249.436	3227.986
BIC	3358.243	3333.024	3334.079
Adjust BIC	3298.065	3250.676	3229.560
Entropy	0.949	0.819	0.920
LMR	125.532**	60.078	34.505

*: $p<0.05$, **: $p<0.01$
AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; LMR=Lo-Mendell-Rubin

Table 7. Class Membership and Item Response Probabilities (N=184)

	Overall malnutrition type (13.5%)	Balanced nutrition type (86.5%)
Mean score of item responses		
Mineral 1	2.632	3.397
Mineral 2	2.586	3.574
Vitamin 1	2.182	3.153
Protein 1	2.011	3.513
Protein 2	2.047	4.274
Water	2.646	2.823

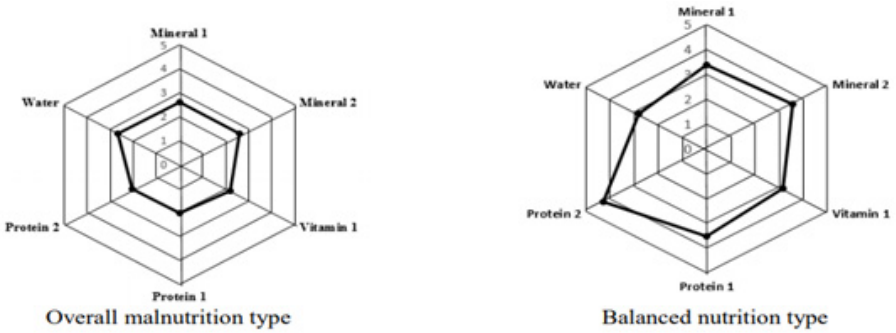

Figure 3. Radar Plots Comparing Two Classes of Nutrition

Compared to passive exercise participation types (with balanced physical activity participation types as the reference group), the lower the level of education, the more likely it is to be included in the passive exercise participation type group.

Compared to the low intensity physical activity participation type (with passive exercise participation type as the reference group), the higher the level of education and the lower the level of health, the more likely it is to be included among the low intensity physical activity participation type group.

In other words, subjects with a higher level of education is 2.17 times more likely to be included in the balanced physical activity participation type group. The higher the probability that a subject resides in a metropolitan area, the lower the level of education; furthermore, the higher the level of health, the higher the probability of belonging to the passive exercise participation type group (Table 8).

4. Predictors by potential type of Activity Participation

When the balanced activity participation type group is used as a reference group and compared with the basic ADL participation type, subjects are more likely to be men, have a greater average number of diseases, and have a monthly income lower than the average.

In comparing inactive types, subjects with lower levels of education and higher levels of health are more likely to be included in the basic ADL participation type group. This demonstrates that women are less likely to have a lower average number of disease, have a higher-than-average income, and are more likely to belong to the balanced activity participation type group at rates of 3.09, 5.43, and 1.43 times, respectively. The higher the level of a subject's education and the lower the level of their health, the more likely they are to be inactive types (at magnitudes of 1.58 and 1.10 times higher, respectively - see Table 9).

5. Predictors by potential type of utrition

In the case of eating habits, subjects with higher levels of education have a greater likelihood to be included in the overall nutritional imbalance group (when the balanced nutrition type was set as the reference group). This showed that the more balanced the nutrition type is, the more likely the education level is to be lowered as a result (by 0.64 times (Table 10).

Table 8. Multinomial Logistic Regression by Physical Activity Types

Reference group	Variables	Comparison group							
		Passive exercise participation type				Low intensity physical activity participation type			
		B (SE)	OR	95% CI		B (SE)	OR	95% CI	
				Lower	Upper			Lower	Upper
Balanced physical activity participation type	Residence	-0.308 (0.349)	0.735	0.371	1.455	0.364 (0.313)	1.439	0.779	2.659
	Gender	0.073 (0.694)	1.076	0.276	4.196	0.023 (0.556)	1.023	0.344	3.040
	Age	-0.061 (0.047)	0.940	0.857	1.032	-0.021 (0.040)	0.979	0.905	1.060
	Disease	-1.518 (0.813)	0.219	0.045	1.079	-0.908 (0.608)	0.403	0.123	1.328
	Living together	-1.648 (0.911)	0.198	0.033	1.183	-1.051 (0.884)	0.349	0.062	1.977
	Education	-0.774** (0.253)	0.461	0.281	0.758	-0.392 (0.231)	0.675	0.429	1.062
	Average monthly income	-0.388 (0.228)	0.678	0.434	1.060	-0.256 (0.191)	0.774	0.533	1.126
	Quality of life	0.029 (0.028)	1.029	0.975	1.087	0.003 (0.025)	1.003	0.956	1.053
	Health	-0.011 (0.050)	0.989	0.897	1.090	0.057 (0.042)	1.058	0.975	1.149
Passive exercise participation type	Residence	-	-	-		0.672** (0.232)	1.959	1.243	3.088
	Gender	-	-	-		-0.051 (0.565)	0.950	0.314	2.877
	Age	-	-	-		0.041 (0.034)	1.041	0.975	1.112
	Disease	-	-	-		0.610 (0.709)	1.840	0.459	7.386
	Living together	-	-	-		0.566 (0.439)	1.762	0.745	4.164
	Education	-	-	-		0.382* (0.154)	1.465	1.084	1.979
	Average monthly income	-	-	-		0.133 (0.169)	1.142	0.820	1.589
	Quality of life	-	-	-		-0.026 (0.019)	0.975	0.938	1.013
	Health	-	-	-		0.068* (0.034)	1.070	1.001	1.144

*: $p<0.05$, **: $p<0.01$

Table 9. Multinomial Logistic Regression by Activity Participation Types

Reference group	Variables	Comparison group							
		Inactive type				Basic ADL participation type			
		B (SE)	OR	95% CI		B (SE)	OR	95% CI	
				Lower	Upper			Lower	Upper
Balanced activity participation type	Residence	0.579 (0.364)	1.785	0.875	3.639	0.143 (0.234)	1.153	0.729	1.824
	Gender	-0.796 (0.757)	0.451	0.102	1.990	-1.127* (0.534)	0.324	0.114	0.922
	Age	0.043 (0.047)	1.043	0.952	1.144	0.032 (0.032)	1.032	0.969	1.100
	Disease	-0.974 (0.907)	0.378	0.064	2.233	-1.694** (0.560)	0.184	0.061	0.551
	Living together	-0.878 (0.699)	0.416	0.106	1.636	-0.474 (0.464)	0.622	0.251	1.546
	Education	0.462 (0.245)	1.587	0.982	2.562	0.005 (0.148)	1.005	0.752	1.344
	Average monthly income	-0.309 (0.225)	0.734	0.472	1.142	-0.355* (0.148)	0.701	0.524	0.938
	Quality of life	-0.033 (0.028)	0.968	0.915	1.023	-0.036 (0.019)	0.964	0.930	1.000
	Health	0.055 (0.042)	1.056	0.973	1.146	-0.041 (0.032)	0.960	0.901	1.022
Inactive type	Residence	-	-	-		-0.437 (0.321)	0.646	0.345	1.212
	Gender	-	-	-		-0.331 (0.660)	0.718	0.197	2.618
	Age	-	-	-		-0.011 (0.041)	0.989	0.913	1.072
	Disease	-	-	-		-0.720 (0.899)	0.487	0.084	2.835
	Living together	-	-	-		0.404 (0.617)	1.498	0.447	5.022
	Education	-	-	-		-0.456* (0.222)	0.634	0.410	0.979
	Average monthly income	-	-	-		-0.046 (0.211)	0.955	0.632	1.443
	Quality of life	-	-	-		-0.003 (0.025)	0.997	0.948	1.048
	Health	-	-	-		-0.096** (0.036)	0.909	0.847	0.975

*: $p<0.05$, **: $p<0.01$

Table 10. Multinomial Logistic Regression by Nutrition Types

Reference group	Variables	Comparison group: Overall malnutrition type			
		B (SE)	OR	95% CI	
				Lower	Upper
Balanced nutrition type	Residence	-0.068 (0.295)	0.935	0.524	1.667
	Gender	0.763 (0.594)	2.144	0.670	6.868
	Age	0.038 (0.037)	1.039	0.965	1.118
	Disease	-0.106 (0.735)	0.900	0.213	3.802
	Living together	1.165 (0.686)	3.206	0.836	12.294
	Education	0.448* (0.203)	1.565	1.051	2.329
	Average monthly income	0.188 (0.177)	1.206	0.852	1.707
	Quality of life	0.002 (0.022)	1.002	0.960	1.047
	Health	0.028 (0.034)	1.029	0.963	1.099

*: $p<0.05$

Ⅳ. Discussion

The aim of the study was to identify multifaceted lifestyle patterns among community-dwelling older adults and to analyze characteristics by both types and predictive factors via LPA. Our results from the use of LPA highlight that there are several distinct lifestyle patterns in older adults. First, we identified three latent classes of physical activity in older adults in Korea: least active types, low intensity exercise types, and athletic types. These classes can be supported by previous research (Kim & Song, 2012; Mooney et al., 2015). Second, in terms of activity participation, three latent classes were identified: active types, basic activity (ADL) participation types, and balanced activity participation types. Last, there are two latent classes in nutrition: overall malnutrition types and balanced nutrition types. The research demonstrates that there are different lifestyle patterns in physical activity, activity participation, and nutrition among older adults.

These results are similar to the Soregren's study (2014). Two classes were identified when they used latent class modeling to examining clustering effect of healthy-lifestyle pattern among old adults

(Soregren et al., 2014). They conclude that older adults can be classified as being either "healthier" or "less healthy". However, this study did not consider multifaceted lifestyle factors simultaneously. The analysis based on physical activity, activity participation, and nutrition in the present study can more clearly explain the multifaceted lifestyle patterns present among older adults.

We found that education level and socioeconomic status are negatively associated with the probability of belonging to the unhealthy lifestyle type groups – such as the inactive/unbalanced lifestyle type group and the low intensity activity focused lifestyle type group. The literature proposes that older adults who have higher education levels and who are healthier tend to have healthy lifestyle behaviors; thus, higher educational levels is related to belonging to the healthy lifestyle groups (Ovrum, 2011; Zanjani et al., 2015). In this context, this finding suggests that education is a crucial factor for maintaining health and constructing a healthy lifestyle. Therefore, in order to provide support for older adults' attempts at having healthy lifestyles, education surrounding health and healthy lifestyles should be provided.

A multinomial logistic regression analysis was conducted to determine the influencing factors that distinguish each latent group. First of all, factors that distinguish passive exercise participation type from low intensity exercise participation type in the potential types of physical activity included the size of the city of residence, education level, and health level. As opposed to studies of older adults living in large cities (Bang, Kim, & Heo, 2009; Lee & Choi, 2011), these results may have been interpreted because the questionnaire used had fewer items related to exercise requiring special instruments, and most places had conditions for exercise in community centers or senior citizen centers. The factors that distinguish between balanced physical activity participation type and passive exercise participation type are education levels, and studies have shown that higher education levels increase the likelihood of participating in physical activities (Seo, Kang, & Jeon, 2016). Second, the factors that distinguish balanced activity participation and basic ADL participation type in the latent types of activity participation were higher in women, the more disease-free and the higher average income, such as the results of Hur (2014). Inactivity type and basic ADL participation type could be distinguished by education level and health level, and in the case of education level, the lower the number of participation in educational activities can be interpreted as having a lower level of education. Third, the factors that distinguish balanced nutrition type from overall malnutrition in nutrition latent types were education levels, indicating that nutritional intake varies depending on the level of education, according to studies by Kim, Hong and Kim (2008).

The literature recognizes that evidence concerning the healthy lifestyles of older adults affects their health and quality of life (Ferreira, Meireles, & Ferreira, 2015). Thus, lifestyle may have crucial implication for design of intervention programs aimed at improving health and the quality of life of older adults (Hu, Liu, & Willett, 2011; Jackson, Zemke, Nelson, & Clark, 1999; WHO, 2015). In terms of the design of lifestyle modification programs, there is a lack of multi-faceted lifestyle

considerations and assessments that can evaluate an individual's lifestyle patterns. Through this study, it is recommended that client-centered health care services and interventions are tailored according to the cluster of older adults. Additionally, further study is required to develop the tool which can evaluate older adults' lifestyle and profile individual's lifestyle patterns.

The present study has certain limitations. First, the sample size of the study is relatively small, and thus, the results of the research should be interpreted carefully. Additionally, there were missing observations in the retirement variable of the demographic information section. In order to deal with this missing data, pairwise deletion method was applied. Thus, there might have the low level of bias in the results (Roth & Switzer, 1995; Switzer, Roth, & Switzer, 1998). Therefore, there is a limitation to generalize the results to the whole elderly population in South Korea. This is because LPA is a person-centered analytic approach that is sensitive to the characteristics of the sample (Celeux & Soromenho, 1996). Therefore, it is necessary to ensure that similar results could be derived from larger sample sizes in further studies. Second, the use of self-reported questionnaires may lead to measurement errors – including under- and over reporting of lifestyle patterns (Ferrari, Friedenreich, & Matthews, 2007; Richardson, Ainsworth, Jacobs, & Leon, 2001). Third, the study faces methodological limitations common to cross-sectional surveys; thus, these must be considered when interpreting the results.

V. Conclusion

This study illustrates that there are different types of lifestyles among older adults. Moreover, older adults of three types exhibit different sociodemographic characteristics. Higher education levels and better self-reported health are associated with being among a healthier lifestyle type group. Based on the results of this research, an empirical and policy intervention strategy should be developed and implemented according to the lifestyle type groups for increasing health and quality of lifestyles of older adults.

Acknowledgements

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2018S1A3A2074904).

References

Bang, Y. S., Kim, H. Y., & Heo, M. (2009). Relationships between physical activity participation depression and body function of the elderly in community. *The Korea Contens Society, 9*(10), 227-237. doi:10.5392/JKCA.2009.9.10.227

Bartos, R. (1980). Over 49-the invisible consumer market. *Harvard Business Review, 58*(1), 140-148.

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification, 13*(2), 195-212. doi:10.1007/BF01246098

Chung, M. J., Kwak, T. K., Kim, H. Y., & Kang, M. (2018). Development of NQ-E, Nutrition Quotient for Korean elderly: Item selection and validation of factor

structure. *Journal of Nutrition and Health, 51*(1), 87-102. doi:10.4163/jnh.2018.51.1.87

Clark, F., Jackson, J., Carlson, M., Chou, C. P., Cherry, B. J., Jordan-Marsh, M., ... Azen, S. P. (2012). Effectiveness of a lifestyle intervention in promoting the well-being of independently living older people: Results of the well elderly 2 randomised controlled trial. *Journal of Epidemiology and Community Health, 66*(9), 782-790. doi:10.1136/jech.2009.099754

Collins, L. M., Fidler, P. L., Wugalter, S. E., & Long, J. D. (1993). Goodness-of-fit testing for latent class models. *Multivariate Behavioral Research, 28*(3), 375-389. doi:10.1207/s15327906mbr2803_4.

Engel, J. F., Blackwell, R. D., & Kollat, D. T. (1982). *Consumer behavior* (4th ed.), New York: The Dryden Press.

Ferrari, P., Friedenreich, C., & Matthews, C. E. (2007). The role of measurement error in estimating levels of physical activity. *American Journal of Epidemiology, 166*(7), 832-840. doi:10.1093/aje/kwm148

Ferreira, L. K., Meireles, J. F. F., & Ferreira, M. E. C. (2015). Evaluation of lifestyle and quality of life in the elderly: A literature review. *Revista Brasileira de Geriatria e Gerontologia, 21*(5), 616-627. doi:10.1590/1981-22562018021.180028

Godwin, M., Streight, S., Dyachuk, E., van den Hooven, E. C., Ploemacher, J., Seguin, R., & Cuthbertson, S. (2008). Testing the simple lifestyle indicator questionnaire: Initial psychometric study. *Canadian Family Physician, 54*(1), 76-77.

Hu, F. B., Liu, Y., & Willett, W. C. (2011). Preventing chronic diseases by promoting healthy diet and lifestyle: Public policy implications for China. *Obesity Reviews, 12*(7), 552-559. doi:10.1111/j.1467-789X.2011.00863.x

Hur, J. S. (2014). Determinants of social participation activities among the elderly persons. *Journal of Welfare for the Aged, 64*, 235-263. doi:10.21194/kjgsw.64.201406.235

Jackson, J. M., Zemke, R., Nelson, L., & Clark, F. (1999). *Lifestyle redesign: Implementing the well elderly program* (1st ed.). Bethesda, MD: AOTA Inc.

Jedidi, K., Ramaswamy, V., & Desarbo, W. S. (1993). A maximum likelihood method for latent class regression involving a censored dependent variable. *Psychometrika, 58*(3), 375-394. doi:10.1007/BF02294647

Jeon, H. S. (2016). A study on the lifestyle and the quality of life of senior citizens based on literature examination. *Korean Journal of Sports Science, 25*(4), 135-149.

Jeon, H. S. (2017). A study on the lifestyles in old age based on scale reorganization. *Korean Journal of Sports Science, 26*(4), 193-206. doi:10.35159/kjss.2017.08.26.4.193

Ji, B. T., Seok, S. J., Sin, D. M., Jung, J. H., & Kim, J. W. (2010). Analysis on the effects of health exercise by lifestyle patterns of the elderly. *Korean Journal of Health Education and Promotion, 27*(2), 69-78.

Kang, E. N. (2017). Current state and challenges of senior employment programs. *Health and Welfare Policy Forum, 2017*(9), 28-39.

Kang, E. N., & Lee, M. H. (2014). An exploratory study of social network type among nursing home residents: Focusing on external relationship resources of nursing facilities. *Health and Social Welfare Review, 34*(2), 133-160. doi:10.15709/hswr.2014.34.2.133

Kim, K. R., Hong, S. A., & Kim, M. K. (2008). Nutritional status and food insufficiency of Korean population through the life-course by education level based on 2005 National Health and Nutrition Survey. *The Korean Nutrition Society, 41*(7), 667-681.

Kim, M. O., & Cho, A. M. (2018). Relation between career choice factors and life satisfaction of youth by latent profile analysis. *Korean Journal of Youth Studies, 25*(12), 85-107. doi:10.21509/KJYS.2018.12.25.12.85

Kim, S. H., & Hong, K. J. (2010). A study on the welfare attitude of Seoul citizens using the latent class analysis. *Social Welfare Policy, 37*(2), 95-121. doi:10.15855/swp.2010.37.2.95

Kim, S. S., & Song, J. A. (2012). Investigation of the factors relative to the health promotion behavior practice among Korean elders residing in a retirement community. *Journal of the Korea Gerontological Society, 32*(1), 51-66.

Lee, H. J., & Kim, D. J. (2011). Cultural adaptation and reliability testing of Korean version of the world health organization disability assessment schedule 2.0: 12-items version. *Journal of the Korean Society of Physical Medicine, 6*(4), 475-488.

Lee, Y. H., & Choi, M. K. (2011). Fear of falling, depression, physical fitness and physical activity among community dwelling elders. *Korean Journal of Adult*

Nursing, 23(4), 351-362.

Lo, Y., Mendell, N., & Rubin, D. (2001). Testing the number of components in a normal mixture. *Biometrika, 88*(3), 767-778. doi:10.1093/biomet/88.3.767

Magidson, J., & Vermunt, J. (2002). Latent class models for clustering: A comparison with K-means. *Canadian Journal of Marketing Research, 20*(1), 37-44.

Ministry of Health and Welfare. (2017). *Living profiles of older people survey in Korea. 2017*. Retrieved from http://www.mohw.go.kr/react/jb/sjb030301vw.jsp?PAR_MENU_ID=03&MENU_ID=032901&page=1&CONT_SEQ=344953

Min, S. K., Kim, K. I., Lee, C. I., Jung, Y. C., Suh, S. Y., & Kim, D. K. (2002). Development of the Korean version of WHO quality of life scale and WHOQOL-BREF. *Quality of Life Research, 11*(6), 593-600. doi:10.1023/a:1016351406336

Mooney, S. J., Joshi, S., Cerda, M., Quinn, J. W., Beard, J. R., Kennedy, G. J., ... Rundle, A. G. (2015). Patterns of physical activity among older adults in New York city. *American Journal of Preventive Medicine, 49*(3), 13-22. doi:10.1016/j.amepre.2015.02.015

Moon, S. M. (2014). Types of health behavior clusters and related factors among Korean adults. *Journal of Digital Convergence, 12*(8), 397-410. doi:10.14400/JDC.2014.12.8.397

Neugarten, B. L. (1968). *Middle age and aging*. Chicago: University of Chicago Press.

Nylund, K. L., Asparouhov, T., & Muthen, B. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling, 14*(4), 535-569. doi:10.1080/10705510701575396

Ovrum, A. (2011). Socioeconomic status and lifestyle choices: Evidence from latent class analysis. *Health Economics, 20*(8), 971-984. doi:10.1002/hec.1662

Park, K., Han, D., Park, H. Y., Ha, S. M., & Park, J. (2019). Pilot research for development of multi-faceted lifestyle profile components affecting health and quality of life: Delphi survey. *Korean Journal of Occupational Therapy, 27*(3), 105-120. doi:10.14519/kjot.2019.27.3.08

Park, K. H., & Park, J. H. (2019). Analysis of convergent influence of functional level, environmental factors and lifestyle on health and quality of life among elderly using structural equation model. *Journal of the Korea Concergence Society, 10*(12), 377-386. doi:10.15207/JKCS.2019.10.12.377

Park, K. H., Won, K. A., & Park, J. H. (2019). Systematic study on the multifaceted lifestyle assessment tools for community-dwelling elderly: Trend and application prospect. *Therapeutic Science for Rehabilitation, 8*(3), 7-29. doi:10.22683/tsnr.2019.8.3.007

Richardson, M. T., Ainsworth, B. E., Jacobs, D. R., & Leon, A. S. (2001). Validation of the Stanford 7-day recall to assess habitual physical activity. *Annals of Epidemiology, 11*(2), 145-153. doi:10.1016/s1047-2797(00)00190-3

Roley, S. S., DeLany, J. V., Barrows, C. J., Brownrigg, S., Honaker, D., Sava, D. I., ... Youngstrom, M. J. (2008). Occupational therapy practice framework: Domain & process 2nd edition. *The American Journal of Occupational Therapy, 62*(6), 625-683. doi:10.5014/ajot.62.6.625

Roth, P. L., & Switzer, F. S. III. (1995). A Monte Carlo analysis of missing data techniques in an HRM setting. *Journal of Management, 21*(5), 1003-1023. doi:10.1016/0149-2063(95)90052-7

Seo, Y. M., Kang, M. S., & Jeon, M. Y. (2016). Predictive factors on level of physical activity in the community dwelling elderly. *Journal of the Korea Convergence Society, 7*(6), 151-160. doi:10.15207/JKCS.2016.7.6.151

Sodergren, M., Wang, W. C., Salmon, J., Ball, K., Crawford, D., & McNaughton, S. A. (2014). Predicting healthy lifestyle patterns among retirement age older adults in the WELL study: A latent class analysis of sex differences. *Maturitas, 77*(1), 41-46. doi:10.1016/j.maturitas.2013.09.010

Song, M. O., Jang, A. R., Jung, M. J., Hong, M., & Jang, C. (2013). Occupational therapy students perceive research on image. *Journal of The Korean Society of Integrative Medicine, 1*(3), 97-109. doi:10.15268/ksim.2013.1.3.097

Switzer III, F. S., Roth, P. L., & Switzer, D. M. (1998). Systematic data loss in HRM settings: A Monte Carlo analysis. *Journal of Management, 24*(6), 763-779. doi:10.1016/S0149-2063(99)80083-X

Wang, L., Lee, J. G., & Hwang, J. H. (2019). A big-data analysis on older adult's health and safrty issues. *Journal of the Korea Contents Association, 19*(4),

336-344. doi:10.5392/JKCA.2019.19.04.336
World Health Organization. (2000). *International Classification of Functioning, Disability and Health: ICF.* Geneva: World Health Organization.
World Health Organization. (2015). *Noncommunicable disease. 2015.* Retrieved from http://www.who.int/mediacentre/factsheets/fs355/en/
Zanjani, S., Tol, A., Mohebbi, B., Sadeghi, R., Jalyani, K. N., & Moradi, A. (2015). Determinants of healthy lifestyle and its related factors among elderly people. *Journal of Education Health Promotion, 4,* 1-5. doi:10.4103/2277-9531.171817

국문초록

잠재프로파일 분석을 활용한 한국 노인 라이프스타일 유형화와 영향요인 분석

박강현[*], 양민아[**], 원경아[***], 박지혁[****]

[*]강원대학교 작업치료학과 강사

[**]오산시 치매안심센터 작업치료사

[***]인천광역시 광역치매센터 작업치료사

[****]연세대학교 소프트웨어디지털헬스케어융합대학 작업치료학과 교수

목적 : 본 연구는 고령자의 라이프스타일이 어떤 형태로 유형화되는지에 대해 라이프스타일 잠재 집단 유형을 분석하고 각 집단의 유형별 특성을 파악하여 고령자의 건강과 삶의 질 증진을 위한 기초자료를 마련하기 위해 수행되었다.

연구방법 : 본 연구에는 횡단연구방법이 사용되었다. 2019년 4월부터 5월까지 고령자의 라이프스타일 유형을 파악하기 위해 만 65세 이상의 국내 지역사회 거주 노인 184명을 대상으로 설문조사가 이루어졌다. 수집된 설문자료를 활용하여 잠재프로파일분석(LPA)을 실시하였고, 도출된 각 유형별 특성과 영향요인을 확인하기 위해 x^2 검정, 다항로지스틱회귀분석 등을 활용하였다.

결과 : 연구결과, 고령자의 라이프스타일은 중 첫 번째 영역인 신체적 활동부분에서는 '소극적 운동 참여형(31.1%)', '저강도 운동 집중형(54.5%)'과 '균형적 운동 참여형(14.5%)'인 3개의 잠재집단으로 분류되었다. 활동 참여의 경우 '비활동형(12%)', '생활유지형(61%)', '활동적 노년형(27%)'인 3집단으로 분류되었으며, 마지막 식이습관에 대한 경우 '전반적 영양부족형(13.5%)'과 '균형적 영양 섭취형(86.5%)' 2집단으로 분류되었다. 또한 라이프스타일 유형이 고령자의 건강과 삶의 만족도에 미치는 영향을 파악하기 위해 다항로지스틱회귀분석을 실시한 결과, 활동적・균형적 라이프스타일에 속할수록 삶의 질과 건강수준이 전반적으로 높은 곳으로 확인되었다. 또한 이러한 유형의 예측요인에서 성별, 교육수준, 거주지역 등이 주요하게 작용하는 것으로 나타났다.

결론 : 고령자가 보다 다양한 활동에 균형적으로 참여하고, 활동적인 일상생활을 수행할 때 건강과 삶의 만족도가 증진됨이 분석되었다. 따라서 본 연구결과를 토대로 고령자의 라이프스타일 유형에 맞춘 실증적・정책적 개입 방안을 제안하였다.

주제어 : 건강, 고령자, 라이프스타일, 영향요인, 잠재프로파일분석