The relationship between digital literacy, loneliness, quality of life, and health-promoting behaviors among the elderly in the age of COVID-19

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ABSTRACT

Social distancing and the expansion of the digital environment due to the impact of COVID-19 are raising the need for digital literacy among the elderly for overall social participation such as mutual communication, health care, and education. The purpose of this study was to identify the correlation between digital literacy, loneliness, quality of life, and health promotion behaviors among the elderly aged between 65 and over and under 75 years. The data collection for this study was from May 1 to June 1, 2021, after approval from the C University Bioethics Review Committee using online questionnaires for 159 young-old elderly living in Korea. This study was a descriptive correlation study to understand the relationship between these variables for the young-old elderly. The collected data were analyzed using IBM SPSS WIN/25.0. The general characteristics were frequency, mean, and standard deviation, the difference of variables according to the general characteristics was analyzed by t-test and one-way ANOVA, and post-analysis was analyzed by Scheffe's test. The correlation between each variable was analyzed using Pearson's correlation. The subjects' digital media literacy was positively correlated with quality of life and health promotion behavior. Loneliness was inversely correlated with quality of life and health-promoting behavior. Quality of life was positively correlated with health-promoting behavior. Based on the results of this study, it is suggested that digital literacy education programs for the elderly in the future are necessary to reduce the elderly's feeling of loneliness and improve the quality of life and health promotion behaviors.

1. Introduction

Currently, the elderly have experienced unprecedented industrialization in the world during the Japanese colonial period and the Korean War in Korea, and are living in an era of rapid change from the information society to the era of the 4th industrial revolution (Jee et al., 2019). Due to the rapid aging of the population, Korean society, which is expected to account for 15.7% of the population aged 65 and over in 2020, 20.3% in 2025, and 43.9% in 2060, is demanding various welfare policies for the elderly. As it entered the aging society and quality of life of the elderly has become an important axis of social welfare. In old age, family relationships and social interactions, such as retirement or the death of a spouse, decrease. These changes lead to a decrease in social bonds and loss of social networks, which leads to depression, anger disorder, loneliness, suicide, and fear. As the Internet is popularized, the inequality of online use is further exacerbating the alienation of the elderly from the information-vulnerable class. This is because older people with higher digital literacy (the ability to identify, access, and use digital information) have higher self-esteem and have a positive effect on life satisfaction. By empirically analyzing the effects of digital literacy among the elderly on their feelings of loneliness, quality of life, and health promotion, cultivating digital literacy among the elderly and reducing the information gap are the most important welfare policies for the elderly and prepare for a super-aged society. Since the level of information acquisition and participation varies according to the level of digital literacy, it is recognized that improving digital literacy is very important in resolving the information gap problem (Oh, 2017).

In an aging and information society, the use of information and communication technologies such

as computers and the Internet is mentioned as a major component of positive life satisfaction (Yoo and Son, 2012). Online activities to communicate with others, prevent social isolation, and maintain bonds are a means to improve the quality of life of the elderly (Kim and Jun, 2014). Accordingly, interest in the role played by information and communication technology to improve the mental and physical stability and life satisfaction of the elderly is increasing. For the elderly in Korea, loneliness is pointed out as a serious problem experienced in old age after economic difficulties and health problems. Although there are various factors that aggravate the feeling of loneliness in the elderly, psychological and social atrophy due to loss of social role and health status were found to be the most related (Prieto-Flores et al., 2011). It has been reported that elderly people living alone feel lonelier, but living alone does not mean that everyone suffers from loneliness, and the lack of a relationship where they can truly share their feelings is a bigger factor.

In 2019, about 4 out of 10 people over the age of 13 were satisfied with their current life, whereas only 1 out of 4 people over the age of 65 reported that they were satisfied with their current life, a decrease of 4.9% compared to 2018. Based on the age of 70, the average internet and smartphone usage rate for all age groups under 70 years old is 96.4%, and for those over 70 years old, simple use such as mobile internet use is about 35%, but other complex uses such as e-mail or internet banking are about 6% only appears to be used. Therefore, the need for digital literacy is raised to improve the quality of life of the elderly. Older people, like young people, can change their lives in a positive way by using the Internet to broaden interpersonal relationships, enjoy conversations, and search for jobs.

In addition, as the use of digital devices improves psychological confidence and self-efficacy, it also affects the quality of life, so digital use by the elderly is considered to be the most important priority in the era of Corona (Yoo and Son, 2012).

As the smartphone ownership rate of the elderly increases, interest in health management and prevention through smartphones is increasing. In particular, since many elderly people have chronic diseases, health care contents and programs for the elderly are insufficient. It is necessary to develop a health care service customized for the elderly in Korea and the usefulness of health care to regularly manage health conditions and prevent worsening of symptoms is raised (Jung et al., 2018). In the case of the elderly looking for health information by themselves using a smartphone, they were satisfied with the information obtained through these efforts and showed confidence that they could manage their own health through such satisfaction. If you think health information is useful like this, it is highly related to online health-related behavior (Park et al., 2013), considering that health information apps are useful, continuous use of health information apps can be induced.

In order to reduce the information gap and social alienation of the elderly, efforts to strengthen their digital literacy are required. Whereas the discussion of the information gap in the past focused on access and use of Computers, the present focus is more on strengthening digital literacy capabilities such as device access and use, understanding and utilization of content, information sharing, communication, and participation (Oh and Yoo, 2018). Therefore, by analyzing the correlation between the digital literacy and smartphone use of the elderly, their sense of loneliness, quality of life, and health promotion behavior for the elderly, this study intends to use it as basic data for preparing a program to increase health promotion behavior by promoting digital literacy.

The purpose of this study is to identify the correlation between digital literacy, loneliness, quality of life, and health promotion behaviors among the elderly aged between 65 and over and under 75 years. This is to prepare interventions and strategies for the ultimate quality of life improvement, and the specific objectives are as follows. The research question is whether digital literacy in the young-old elderly is related to loneliness, quality of life, and health promotion behavior?

The specific purpose is as follows:

1) Identify the subject's digital literacy, loneliness, quality of life, and health promotion behavior.
2) Identify the differences in digital literacy, loneliness, quality of life, and health promotion behavior according to the individual's characteristics.
3) Identify the correlation between the subject's digital literacy, loneliness, quality of life, and health promotion behavior.

2. Theoretical background of the study

With the recent development of the Internet and the digital environment, people's lives are rapidly changing. Because the use of digital devices provides opportunities for diverse experiences, the ability to accurately utilize them is important not only for the young but also for the elderly. Digital literacy is a dictionary definition of the concept of the ability to read and write, and it refers to the ability to live in a networked society with the knowledge and ability to perform desired tasks through digital devices. Prior to the widespread use of digital devices, the use of technology and devices was important, but as devices became more common, the use of devices, users' perceptions and attitudes, and approaches that allow individuals to operate conveniently, communication and problems in the digital environment A conceptual extension was made to collaboration for a solution. Information literacy, ICT literacy, computer literacy, electronic literacy, and

digital media literacy are used as terms commonly used as the same concept (Jee et al., 2019).

The expanded concept of digital literacy has raised the possibility of social disparities in access and use of digital devices (Kim and Shim, 2020), and as the digital environment has changed rapidly, the digital divide between individuals, households, and regions has become a reality (Friemel, 2016). In the three general types of the digital divide, the first-generation information gap concept is divided into unequal access to information and communication technology, the second-generation is the skill, and the third-generation is the concept of opportunity. In terms of use, it is divided into a quantitative gap and a qualitative gap. Such a digital gap inevitably exists for each social class, and a new digital environment inevitably creates a new gap, causing stratification of the digital gap. Therefore, policies and social support for resolving the digital divide are continuously being developed and issued (Kim and Shim, 2020).

Digital literacy refers to the use and access of information and communication devices such as smartphones, PCs, tablets, wearables, IoT devices, etc. it means. It is a concept that includes not only these quantitative aspects but also the qualitative aspects that expand the wisdom of life through it (Oh, 2017). Digital technology is used smoothly among young people, men, and high-educated groups, but the elderly, women, immigrants, the unemployed, and the low-educated groups are vulnerable and are negatively affected by employment opportunities, economic power, social participation, and quality of life. In addition, opportunities for new forms of digital communication and interaction are limited, and psychological problems such as depression, loneliness, and suicide are also increasing as the period of social distancing due to COVID-19 continues. However, digital access and utilization in the welfare of the elderly is a low priority area compared to other areas, so its importance is highlighted in the era of Corona, and policies that reflect this are also considered an urgent task. Factors that hinder the informatization of the elderly are divided into extrinsic and intrinsic factors. External factors include lack of opportunities for informatization education, poor environment, and insufficient system.

If tangible material civilization developed in industrialization, intangible information was the subject of informatization, and if the industrialization era was a vertical culture that emphasized hierarchies, the information society is based on a horizontal culture. In this rapidly changing society, in the case of the elderly who started cognitive aging with existing paradigms and values, learning and acceptance are inevitably accompanied by difficulties (Oh, 2017). Therefore, in order to supplement this, as a policy, customized education in new media should be sufficiently provided to the elderly. Through this, information acquisition and interaction of the elderly will be facilitated, which will have a positive effect on self-efficacy, psychological well-being, life satisfaction, and life satisfaction (Kim and Shim, 2020).

According to the survey on the status of the elderly in 2020, about 35% of people over 70 years old answered that simple use such as mobile Internet use was possible, but only about 6% of other complex applications such as e-mail or Internet banking were possible. This result is a large gap compared to the average of 96.4% of all age groups under 70 years of age. Also, as a result of checking the information gap among OECD member countries, Korea has the largest generational gap.

Korea's young people's digital problem-solving proficiency is at a high level at 60%, but the middle-aged 55-65 years old group also showed lower scores than Japan and Germany. The digital informatization capability and utilization level of the elderly were found to be the lowest compared to other vulnerable groups such as farmers and fishermen, low-income groups, and the disabled.

Even when our society attempts to secure public health through social distancing to prevent the spread of infectious diseases such as Corona, the elderly have no choice but to use face-to-face contact due to their lack of ability to shop online. Since this can become a factor that can threaten the health and life of the people as well as the elderly beyond inconvenience in life, measures to increase the level of digital use are required.

The current media society is improving the quality of life while positively affecting mental and physical health management as the social network using the Internet, smartphones, and smart services are expanded regardless of age. Therefore, health management using smartphones has emerged as one of the biggest issues in the health care industry, and medical services and health management programs using this are actively being developed in clinical fields. Methods that allow more access are being actively studied (Lee et al., 2020).

In a study by An et al. (2020) on the elderly, digital literacy of the elderly was confirmed to improve psychological health through health information behavior. The ability to understand, understand, and solve problems has been found to influence health promotion behaviors.

For the elderly, social participation is very diverse, from altruistic charitable activities such as hobbies and filtering activities, family events, social support gatherings between neighbors, and religious activities to civic activities for the benefit of society as a whole. It was confirmed that the feeling of loneliness decreased and the quality of life increased (Lee, 2018a). In addition, it was confirmed that the loneliness of the elderly acted as an influencing factor on Internet use and indirectly lowered the quality of life by directly affecting the quality of life or affecting the psychological part (Lee, 2018b; 2019). Limited social participation through multi-year social distancing due to COVID-19 is increasing the loneliness and depression of the elderly and lowering the quality of life. Therefore, the necessity

of dissemination, education, and utilization of media devices is more demanded than ever.

3. Research method

3.1. Research design

This study was a descriptive correlation study to understand the relationship between digital literacy, smartphone use, loneliness, quality of life, health promotion behavior, and these variables for the young-old elderly.

3.2. Study subjects

The population of the subjects of this study is the young-old elderly who use digital devices nationwide, and the convenience sampling method was used for the elderly who were registered as members of Macromill Embrain, an online research company. After explaining the research purpose and procedure to the Embrain operator, subjects were recruited through recruitment notices and explanations. The Google questionnaire URL was posted in the recruitment notice. The sample size of this study was determined by correlation analysis using the G*power 3.10 program, with effect size .30 (median), significance level (α) .05, power (1-β) .95, As a result of a two-sided test. The minimum number of people of the appropriate sample size was calculated as 134, but considering the dropout rate of 20%, 161 were selected as the initial subjects. The final analysis was 159 people, excluding two copies with poor responses, who were between the ages of 65 or over and under 75 years, who agreed to understand and cooperate with this study.

3.3. Research tool

This study used a structured questionnaire and consisted of a total of eighty-nine items with questions measuring various characteristics, digital literacy, loneliness, and quality of life health promotion behavior.

3.3.1. General characteristics

For general characteristics, referring to the items used in the previous study (Lim, 2017), the area, gender, age, marital status, cohabitation type, educational background, health status, standard of living, smartphone use time, and smartphone use level were measured with a total of ten questions.

3.3.2. Digital literacy

The digital literacy measurement tool in this study was based on the scale modified by Lim (2020). There are a total of twenty-eight items, and sub-domains are: First, among the technical competencies, eight items of software usage ability and five items of smart device usage ability, secondly

using seven items, 3rd, out of five items of mind competency, two items of motivation for use and three items of normative behavior consists of, items stated as negative were scored in reverse order. It was measured on a five-point Likert scale ranging from 'not at all' (one point) to 'strongly agree' (five points). A higher score indicates a higher level of digital literacy. Reliability for each subdomain was Cronbach's α=.83~.94 in Lim's (2020) study. In this study, Cronbach's α=.95.

3.3.3. Loneliness

The loneliness measurement tool in this study was developed by Vincenzi and Grabosky (1987) and the Emotional Social Loneliness Inventory (ESLI) used by Lim (2017) to study loneliness in the elderly. The sub-factors consist of eight items of emotional loneliness and seven items of social loneliness, for a total of fifteen items. On a four-point Likert scale ranging from 'not at all (one point)' to 'always agree (four points)', a higher score indicates a higher level of loneliness. In the study of Vincenzi and Grabosky (1987), the overall reliability was reported as Cronbach's α=.80. In the Lim (2017) study, the reliability of loneliness was Cronbach's α=.92, Cronbach's α=.85 for emotional loneliness, Cronbach's α=.87 for social loneliness, and Cronbach's α=.90 for this study.

3.3.4. Quality of life

The quality of life measurement tool used in this study was modified and supplemented by Ahn (2016), such as analysis studies on the quality of life of middle-aged adults of 'Ro You Ja.' Sub-factors are divided into three physical factors, five mental factors, four social factors, a total of twelve questions. On a five-point Likert scale ranging from 'not at all (one point)' to 'strongly agree (five points)', a higher score indicates a higher quality of life. In the study of Ahn (2016), the reliability of each sub-factor was Cronbach's α=.77~.87, and in this study, Cronbach's α=.90.

3.3.5. Health promotion

The health-promoting behavior measurement tool in this study is a translation of the Health-promoting lifestyle profile II (HPLP II) corrected by Park (2020) was used. The sub-factors consist of total of twenty-four items: Health responsibility four items, physical activity four items, nutrition four items, spiritual growth four items, interpersonal relationships four items, stress management four items. On a five-point Likert scale ranging from 'not at all dissatisfied (one point)' to 'strongly agree (five points)', the higher the score, the higher the health promotion behavior. In Park (2020)'s study, the reliability of each sub-factor was Cronbach's α=.71~.87, and Cronbach's α=.90 in this study.

3.4. Data collection period and method

Data collection is from May 1 to June 1, 2021, after approval by the C University Bioethics Committee (CSIRB-R2021009). The data collection was done by the subjects who were surveyed by accessing the URL of the recruitment notice. In order to protect the autonomy and rights of the subject, we first received the consent form for participation in the study online from the elderly who agreed to participate in this study. The Google questionnaire was distributed only to the subjects who gave consent, and the questionnaire was completed in a self-filling format. After completing the survey, a gift was sent to the number written in the consent form for research participation, and a separate Google questionnaire was received to maintain anonymity.

3.5. Data analysis

The collected data were analyzed using IBM SPSS WIN/21.0. The significance level of the result was measured as .05, and the reliability of the measurement tool was obtained.

For each character of the subject, frequency (percentage), and the mean and standard deviation of each variable were calculated. Variables according to the characteristics of subjects were measured by t-test and one-way ANOVA, and Pearson's correlation coefficient was obtained for the correlation of variables.

4. Result

4.1. The characteristics of the subject

Table 1 shows the demographic and General Characteristics of Participants. Looking at the characteristics of the subjects, 'Gyeonggi area, etc. (Gyeonggi-do, Incheon, Gangwon, Sejong)' was the largest with 59 people (37.1%), by age, 130 people (81.8%) were '65-69 years old' and 29 people (18.2%) were '70-74 years old', with the majority being '65-69 years old'. By gender, 79 males (49.7%) and 80 females (50.3%) had similar proportions. Marital status was the most with 136 people (85.5%) married. As for the form of family, 137 people (86.2%) lived together in the family. As for the educational background, 85 people (53.5%) had a college degree (including vocational colleges). As for the health status, 76 patients (47.8%) were the usual. The standard of living was usually high with 91 (57.2%). The most frequent use of smartphones was between 1 and 2 hours (58 people (36.5%). As for the degree of smartphone use, '1-3 years old' had the highest number of 109 people (65.3%). The most frequently used time for smartphones was 'more than 3 hours with 75 people (44.9%) (Table 1).

Table 1: Characteristics of participants (N=159)

Variable	Categories	n (%)
Area	Seoul	49(30.8)
	Gyeonggi, Etc (Gyeonggi-do, Incheon, Gangwon, Sejong)	59(37.1)
	Daejeon, Chungcheong	10(6.3)
	Gwangju, Jeolla	10(6.3)
	Busan, Ulsan, Daegu, Gyeongsang	31(19.5)
Age (year)	65-69	130(81.8)
	70-74	29(18.2)
Gender	Male	79(49.7)
	Female	80(50.3)
Married	Marriage	136(85.5)
	Single	5(3.1)
	Bereavement	9(5.7)
	Divorce	7(4.4)
	Separation	2(1.3)
Family form	With family	137(86.2)
	Celibacy	22(13.8)
Education	Less than middle school	9(5.7)
	High school graduate	49(30.8)
	University graduate (including vocational college)	85(53.5)
	Graduate degree	16(10.1)
Health status	Very weak	8(5.0)
	Weakness	14(8.8)
	Usually	76(47.8)
	Health	58(36.5)
	Very healthy	3(1.9)
Standard of living	Very poor	9(5.7)
	Little poverty	30(18.9)
	Usually	91(57.2)
	Relaxation	29(18.2)
Smartphone usage time	<1 hour	20(12.6)
	1-<2 hours	58(36.5)
	2-<3 hours	41(25.8)
	3-<4 hours	25(15.7)
	≥4 hours	15(9.4)
Smartphone usage level(time, frequency) is high	Not at all	4(2.5)
	Not like that	27(17.0)
	Average	73(45.9)
	that's right	48(30.2)
	It really is	7(4.4)

4.2. Degree of digital literacy, loneliness, quality of life, and health-promoting behaviors

Table 2 shows the degree of digital literacy, loneliness, quality of life, and health promotion behaviors. The average score of the subject's digital literacy was 4.09±0.59 out of 5 points, the feeling of loneliness was 1.66±0.50 out of 4 points. The average score of quality of life was 3.55±0.62 out of 5 points, and health promotion action was 3.45±0.49 out of 5 points (Table 2).

Table 2: Descriptive statistics of variables (N=159)

Variables	Min	Max	Mean	SD
Digital literacy	2.25	4.96	4.09	0.59
Loneliness	1.00	3.67	1.66	0.50
Quality of life	1.75	4.83	3.55	0.62
Health promotion	1.75	4.75	3.45	0.49

4.3. Digital literacy, loneliness, quality of life, and health promotion behavior

Table 3 shows digital literacy, loneliness, quality of life, and health promotion behaviors according to the characteristics of the subjects. Digital literacy was higher in male elderly than female elderly (t=3.06, *p*=.003). There was a difference according to the educational background (F=1.31, *p*<.001), and as a result of post-hoc analysis, digital literacy was statistically significantly higher in 'Middle school or lower', 'High school graduate' than 'University graduate (including junior college)' and 'Graduate graduate' group. It was low. There was a difference according to living standards (F=4.21, *p*=.007), and as a result of post-hoc analysis, the 'Very poor' group had a statistically significantly lower digital literacy than other groups.

The feeling of loneliness differed according to marital status (F=5.66, *p*<.001), and as a result of post-hoc analysis, 'Married' was statistically significantly lower than 'Single'. In the family type, the feeling of loneliness was significantly higher in 'Celibacy' than in the case of living 'With family' (t=-2.96, *p*=.007). There was a difference between the groups in health status (F=10.03, *p*<.001). As a result of the post-hoc analysis, the 'Very weak' and 'Weakness' groups showed significantly higher feelings of loneliness than the 'Healthy' and 'Very healthy' groups. The 'Weakness' group was higher than the 'Usually' group. There was a difference according to the standard of living (F=7.81, *p*<.001), and as a result of the post-hoc analysis, the 'Very poor' group had significantly higher feelings of loneliness than the 'Usually' and 'Free' groups.

Quality of life differed according to marital status (F=2.58, *p*=.040), but there was no statistical difference between groups as a result of the post-hoc analysis. In the family type, living 'With a family' had a significantly higher quality of life than 'Celibacy' (t=2.18, *p*=.030). There was a difference according to the educational background (F=3.97, *p*=.009), and as a result of the post-hoc analysis, the quality of life of 'High school graduate' was statistically significantly lower than that of 'University graduate (including

vocational college)' group. Although there was a difference between groups in health status (F=23.40, *p*<.001), as a result of the post-hoc analysis, the health results showed that the 'Very healthy' and 'Healthy' group had a higher quality of life than the 'Very weak', 'Weakness' and 'Usually' groups. There was a difference according to the standard of living (F=14.88, *p*<.001), as a result of the post-hoc analysis, the 'Very poor' group had the lowest and the 'Free' group had the highest quality of life.

Health promotion behaviors differed according to the educational background (F=3.21, *p*=.025), but there was no difference between groups as a result of the post-hoc analysis. There was a difference between the groups in health status (F=8.10, *p*<.001), and as a result of the post-hoc analysis, the 'Healthy' group showed higher health-promoting behavior than the 'Very weak', 'Weakness', and 'Usually' groups and the 'Very healthy' group was higher than the 'Very weak' and 'Weakness' groups. There was a difference according to the standard of living (F=11.05, *p*<.001), and as a result of the post-hoc analysis, the 'Very poor' group had the lowest, and the 'Free' group showed the highest health promotion behavior (Table 3).

4.4. Correlation between digital literacy, loneliness, quality of life, and health promotion behavior

Table 4 shows the correlations between the subjects' digital literacy, loneliness, quality of life, and health promotion behavior. The subjects' digital literacy was positively correlated with quality of life (r=.24, *p*=.002) and health promotion behavior (r=.31, *p*<.001). Loneliness was inversely correlated with quality of life (r=-.63, *p*<.001) and health-promoting behavior (r=-.47, *p*<.001). Quality of life was positively correlated with health-promoting behavior (r=.73, *p*<.001) (Table 4).

5. Discussion

The purpose of this study was to correlate digital literacy, loneliness, quality of life, and health-promoting behaviors in the young-old elderly aged 65 or over and under 75 years of age. Digital literacy was positively correlated with quality of life and health-promoting behavior, and loneliness was inversely correlated with quality of life and health-promoting behavior. Quality of life was positively correlated with health-promoting behavior. This supported previous studies (Oh and Yoo, 2018) that the digital literacy of the elderly affects their depression, loneliness, anxiety, and life satisfaction. As the Internet becomes more popular, inequality in online use is further exacerbating the marginalization of the elderly. In order to reduce depression, loneliness, and anxiety among the elderly and to increase their life satisfaction, it is most important to cultivate digital literacy in the elderly and to reduce the information gap. This can be seen as an important policy task to prepare for a

super-aged society as well as a welfare policy for the elderly.

Table 3: Digital literacy, loneliness, quality of life, and health promotion according to general characteristics (N=159)

Variable	Categories	Digital literacy Mean±SD	t or F(p)Scheffé	Loneliness Mean±SD	t or F(p)Scheffé	Quality of life Mean±SD	t or F(p)Scheffé	Health promotion Mean±SD	t or F(p)Scheffé
Area	Seoul	4.03±0.57		1.70±0.56		3.54±0.63		3.40±0.46	
	Gyeonggi, Etc (Gyeonggi-do, Incheon, Gangwon, Sejong)	4.10±0.60		1.63±0.51		3.48±0.62		3.43±0.52	
	Daejeon, Chungcheong	4.38±0.40	0.73 (.572)	1.58±0.42	0.60 (.657)	3.89±0.42	1.25 (.290)	3.58±0.40	0.96 (.430)
	Gwangju, Jeolla	4.09±0.62		1.50±0.38		3.77±0.81		3.70±0.42	
	Busan, Ulsan, Daegu, Gyeongsang	4.09±0.64		1.74±0.46		3.50±0.57		3.46±0.51	
Age (year)	65-69	4.09±0.60	-0.04 (.967)	1.69±0.51	1.57 (.118)	3.52±0.62	-1.12 (.264)	3.43±0.46	-1.29 (.198)
	70-74	4.10±0.56		1.53±0.43		3.66±0.64		3.56±0.58	
Gender	Male	4.24±0.53	3.06 (.003)	1.70±0.52	0.86 (.388)	3.60±0.61	1.03 (.304)	3.50±0.44	1.07 (.283)
	Female	3.95±0.62		1.63±0.48		3.50±0.63		3.41±0.53	
Marital status	Marriage[a]	4.12±0.58		1.61±0.45		3.59±0.62		3.48±0.51	
	Single[b]	4.04±0.49	0.74 (.565)	2.48±0.74	5.66 (<.001) a<b	2.78±0.35	2.58 (.040)	3.28±0.17	1.62 (.171)
	Bereavement[c]	3.78±0.83		1.70±0.51		3.55±0.41		3.38±0.35	
	Divorce[d]	4.15±0.61		2.05±0.70		3.50±0.73		3.41±0.27	
	Separation[e]	3.92±0.10		2.10±0.51		2.95±0.53		2.66±0.05	
Family form	With family	4.10±0.59	0.48 (.628)	1.60±0.45	-2.96 (.007)	3.59±0.62	2.18 (.030)	3.48±0.51	1.52 (.129)
	Celibacy	4.04±0.56		2.04±0.66		3.28±0.58		3.31±0.34	
Education background	Less than middle school[a]	3.67±0.66		1.62±0.55		3.37±0.53		3.30±0.40	
	High school graduate[b]	3.80±0.61	1.31 (<.001) a, b<c, d	1.77±0.59	1.30 (.274)	3.33±0.53	3.97 (.009) b<c	3.30±0.54	3.21 (.025)
	University graduate (including vocational college)[c]	4.25±0.51		1.64±0.47		3.65±0.54		3.54±0.46	
	Graduate degree[d]	4.38±0.34		1.50±0.31		3.78±0.63		3.59±0.41	
Health status	Very weak[a]	3.94±0.70		2.11±0.79	10.03 (<.001) a, b>d, e b>c	2.68±0.54	23.40 (<.001) a, b<c<d, e a, b, c>e	3.10±0.64	8.10 (<.001) a, b, c<d a, b<e
	Weakness[b]	4.03±0.68	1.26 (.285)	2.16±0.64		2.95±0.61		3.17±0.31	
	Usually[c]	4.02±0.56		1.70±0.45		3.42±0.52		3.36±0.48	
	Healthy[d]	4.23±0.59		1.46±0.34		3.93±0.43		3.67±0.41	
	Very healthy[e]	3.98±0.38		1.13±0.13		4.47±0.33		4.09±0.16	
Standard of living	Very poor[a]	3.46±0.87	4.21 (.007) a<b, c, d	2.29±0.76	7.81 (<.001) a> c, d	2.68±0.65	14.88 (<.001) a<b, c<d	2.77±0.61	11.05 (<.001) a, b, c< d c>a d>a, b
	Little poverty[b]	4.17±0.49		1.83±0.54		3.31±0.59		3.29±0.39	
	Usually[c]	4.10±0.59		1.58±0.41		3.57±0.55		3.50±0.47	
	Free[d]	4.20±0.46		1.55±0.48		3.97±0.48		3.68±0.38	
Smartphone usage time	<1 hour	4.05±0.65		1.72±0.43		3.43±0.73		3.38±0.54	
	1-<2 hours	4.05±0.62	0.31 (.868)	1.60±0.48	0.43 (.786)	3.60±0.58	0.55 (.615)	3.48±0.51	0.47 (.754)
	2-<3 hours	4.17±0.51		1.70±0.54		3.53±0.52		3.45±0.39	
	3-<4 hours	4.12±0.47		1.66±0.50		3.63±0.68		3.53±0.59	
	≥4 hours	4.08±0.79		1.74±0.58		3.38±0.77		3.35±0.40	
Smartphone usage level(time, frequency) is high	Not at all	3.68±0.21		1.63±0.46		3.60±0.74		3.50±0.71	
	Not like that	4.09±0.65	1.02 (.397)	1.69±0.45	0.72 (.573)	3.52±0.60	0.32 (.864)	3.46±0.49	1.53 (.194)
	Average	4.05±0.64		1.63±0.49		3.51±0.59		3.37±0.51	
	that's right	4.20±0.49		1.66±0.55		3.63±0.68		3.59±0.43	
	It really is	4.00±0.57		1.97±0.51		3.46±0.62		3.38±0.38	

Table 4: Correlation among the research variables (N=159)

	Digital literacy	Loneliness	Quality of life	Health promotion
	r(p)			
Digital literacy	1			
Loneliness	-.09(.235)	1		
Quality of life	.24(.002)	-.63(<.001)	1	
Health promotion	.31(<.001)	-.47(<.001)	.73(<.001)	1

The group most vulnerable to access and use of digital devices is the elderly. The digital alienation of the elderly not only reduces the use of digital devices, but also negatively affects the quality of life, economic activity, and social participation of the elderly (Kim and Shim, 2020). In particular, in the rapidly changing digital age, the elderly is a vulnerable group because they have few opportunities to learn. Based on the results of this study, which has a correlation between digital

literacy and quality of life, it can be seen that the resolution of the digital information gap for the elderly is related not only to the survival problem of the elderly but also to the resolution of social imbalances and structural problems of the social economy. For example, in banks, online banking is becoming common, from deposits and withdrawals to loans. In addition, remittances and deposits are actively being made through KakaoTalk on smartphones, there are already more online reservations than on-site reservations for transportation and use of cultural facilities. With the growing number of unmanned kiosks, even in unmanned sales and restaurants, the digital divide among older people is likely to accelerate. Since the level of information acquisition and participation varies according to the level of digital literacy, improving the digital literacy of the elderly is a very important factor in resolving the information gap problem.

Currently, with COVID-19, 'Social distancing' is the best way to prevent the spread of infection. Social activities and daily life are changing in a non-face-to-face manner, going out is decreasing, with the delivery of daily necessities and eating out, the center of consumption has shifted online. Vaccination against COVID-19 is also being conducted through SNS or online reservations. Therefore, the digital alienation of the elderly in daily life has a great impact on the quality of life.

In addition, the use of digital devices is expanding in the era of Corona 19, and the vulnerability of digital devices has a negative effect on communication, affecting the feeling of loneliness. Compared to adolescence and middle age, the elderly spend more time at home and less time and time connected with family and social networks, so they spend relatively more time alone (Lee, 2019). To compensate for this, active participation in community or religious networks is required, but loneliness caused by 'social distancing' can cause other neuropsychiatric problems such as depression, anger disorder, and suicide. The development of intervention programs that are accessible is more demanded than ever.

In addition to the mobile apps that have already been developed, health management of the elderly using smartphones has many advantages, and smart wearables help promote health. The result of this study that digital literacy is correlated with health-promoting behavior is that in a previous study (Kwon et al., 2013), the elderly who searched for health information by themselves using a smartphone was satisfied with the information obtained through these efforts, through such satisfaction, the confidence that they can manage their own health and if they thought that health information was flexible, supported the high correlation with online health-related behaviors. Recently, the Smart Elderly Welfare Policy, which provides services that combine intelligent information technology such as AI, IoT, wearable devices, robots, and smart home services to some elderly living alone, is changing the daily life of the elderly more safely and conveniently. It also improves the quality of life. Therefore, it is urgent to expand the smart elderly welfare policy.

It is necessary to establish a new direction for the elderly welfare policy that will contribute to the improvement of the quality of life of the elderly and the informatization education for the elderly for digital literacy of the elderly.

The results of this study suggest that the promotion of digital literacy so that the elderly who experience information gaps and marginalization can lead normal lives as members of society and improve their quality of life is a very important policy task in terms of digital welfare.

6. Conclusion

This study will be helpful in developing content that can improve the quality of life and health of the elderly by utilizing digital media literacy, and it is expected that the results of this study will be used as basic data for contents composition. Also, since this study was conducted with 159 elderly people, it is difficult to generalize. By supplementing the limitations of this study, it is suggested that various studies be conducted by adding a wide range of subjects and variables in the future.

Digital literacy was higher in male seniors than female seniors, and there is a difference depending on educational background and living standards. Based on the results of this study, it is suggested that digital literacy education programs for the elderly in the future are necessary to reduce the elderly's feeling of loneliness and to increase the quality of life and health promotion behaviors. In addition, in order to generalize the study, it is suggested that the study be repeated by adding the number of subjects and various variables.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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