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A Study on Awareness and Use of Edible Wild Vegetables in Special Forest Products

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Abstract

Purpose: Most processed wild vegetable products are dried, aged, and pickled vegetables. Developing processed wild vegetable foods is necessary to create new high-added value. Therefore, in this study, researchers tried to prepare basic data that can be utilized in various food manufacturing fields in the future through a survey of the awareness and use of edible wild vegetables that require the development of processed wild plants.

Method: This paper investigated the awareness and use of wild vegetables, targeting adult men and women aged 20 or older residing in Daegu and Gyeongbuk. The survey consisted of questions about the perception, the degree of recognition, and the actual use of wild vegetables. As for the wild vegetable items of the awareness survey, 20 kinds of wild vegetables were selected with high awareness and mainly growing naturally in the Gyeongbuk area. Wild vegetable crops' perception and recognition degree were measured using a 5-point Likert scale. Data analysis was performed using the SPSS 27.0 program.

Results: Regarding the degree of recognition of wild vegetables, 'Wild vegetables have a unique scent and taste' was the highest at 4.25. As a result of the knowledge survey for wild vegetable crops, 'Artemisia princeps,' 'Capsella bursa-pastoris,' 'Aralia elata', 'Allium monanthum,' 'Aster scaber', and 'Sedum sarmentosum' showed high awareness in the order. For purchase consideration, the 20s respondents of 61.3% considered 'freshness' the most. For purchase purposes, 'for salads' was the highest at 15.1% in the 30s, and 'for bibimbap' was 42.6% in the 60s and older. Most respondents did not use wild vegetables for 'green juice' and 'decoration.' 'For side dishes' was 70.4% in their 40s, the highest among all age groups(p<0.05).

Conclusion: By investigating consumers' use and awareness of wild vegetables, the survey data can be used for distribution and marketing plans for edible wild vegetables, which are special forest products. In addition, the research results on the purchase purpose of wild vegetables, the actual use of wild vegetable products, and the degree of preference provide basic data for developing high-added-value products by using them in various processed foods and menu development.

Keywords: Forest Products, Wild Vegetables, Awareness, Processed Wild Vegetable Foods, Use of Wild Vegetables

1. Introduction

Forest products refer to products produced in forests, such as trees, timber, fallen leaves, earth and stone, landscaping trees, and bonsai trees. Forests, which occupy about 64% of the country's land, are a source of supply for various forest products such as wild vegetables, chestnuts, and shiitake mushrooms[1]. Their production, supply, and demand continuously increase as their physiological activities and functionality are studied[2]. In particular, forest products

are recognized as a valuable resource for revitalizing the local economy as an important local food and tourism product in the region[1][3]. Among the forest products, by-products excluding main products are called special forest products[4][5]. There are various types, such as edible, medicinal, industrial raw materials, and manufacturing and processing raw materials. Pine nuts, walnuts, acorns, wild vegetables, bamboo shoots, tea, and mushrooms are edible special forest products consumers highly recognize[2][6][7]. However, most of the forest products are distributed in the form of unprocessed raw materials, and processed products of forest products are in short supply[8][9][10]. In the case of wild vegetables, production is concentrated in spring, making it difficult to supply all year round, and commercialization, such as processing and packaging, needs to be improved[11][12][13]. Hence, consumption is lower than that of general agricultural products, so it will be important to enable continuous sales[14][15][16][17].

Wild vegetables refer to plants that can be used for food among plants that grow naturally in mountains or fields rather than crops that have been artificially improved and nurtured[18][19]. Among the plant resources distributed throughout Korea, 480 species can be used for food. About 90 species of wild vegetables with good palatability and high food value are distributed evenly across the country[20][21][22].

Wild vegetables generally have their own unique taste and aroma, and most of them contain special pharmacological components, so they are also very valuable as health foods[23][24].

As awareness and interest in healthy food and natural food increase, the demand for wild vegetables rich in vitamins and minerals and containing a large amount of various physiologically active substances is increasing, and consumption patterns are diversifying[25]. Wild vegetables are low-fat and low-calorie foods and are an important ingredient in Korean cuisine, suitable for modern people's demand for healthy food[26][27]. However, wild vegetables are at a low level of the processing; most are shipped in their original form or simple products. Therefore, since it is difficult to guarantee a stable farm household income depending on the volume and price fluctuations, systematic processing technology development is urgently needed[1][28].

In most wild vegetables, a significant amount of physiologically active substances, such as flavonoids and polyphenol compounds, remain during the drying process, and their content increases instead during the drying process[29][30]. These dried wild vegetables have been restored by water-soaking and are mainly used as main side dishes for Korean meals. However, they are also food ingredients that ordinary consumers would like to avoid because the restoration method is cumbersome and requires much labor, depending on the type of wild vegetables[31]. Because wild vegetables are difficult to utilize in a dry state, they also can be used as raw materials for processed foods by transforming them into powder or liquid, which are easy to mix with other ingredients[3][32]. Most processed wild vegetable products are dried, aged, and pickled vegetables. Developing processed wild vegetable foods is necessary to create new high-added value[4][33]. Therefore, in this study, researchers tried to prepare basic data that can be utilized in various food manufacturing fields in the future through a survey of the awareness and use of edible wild vegetables that require the development of processed wild plants.

2. Advance Research

In advance studies, 10 wild vegetables from Gangwon-do were studied on antioxidant activity and cognitive ability improvement[9]; Wild vegetables were reported to improve insulin resistance by reducing oxidative stress [24]; Antioxidants derived from 38 kinds of wild vegetables were explored[21]; Antioxidant activity and antibacterial activity of wild vegetable extracts were investigated[14]; The functional and aromatic component contents of wild vegetable young leaves were compared and analyzed[26]; The polyphenol content of 8 kinds of Korean wild vegetables was analyzed. A study on the peroxynitrite scavenging effect has been conducted, which causes lipid and protein peroxidation and cytotoxicity[29]. Its value as a functional food material was confirmed;

In addition, studies were conducted to enhance the consumption activity and competitiveness of wild vegetables by identifying consumption trends of wild vegetables and surveying consumers' awareness, usage, repurchase intention, and satisfaction[4][5][8]; However, studies on grafting wild vegetables as functional food materials are insufficient, such as wild vegetable water kimchi[1] and pancakes(Jeonbyeong) added with *'Cedred Sinensis'* powder[17].

In advanced studies on *'Aster yomena'* grafted onto food, The production of vegetable and seaweed chips(Bugak) using *'Aster yomena'* was investigated[14]; The quality characteristics of cookies[21] and plain bread[27] with the addition of *'Aster yomena'* powder were investigated. There are few studies on food related to *'Aster pseudoglehnii,'* except for a study investigating the physicochemical characteristics of kimchi according to ripening changes using *'Aster pseudoglehnii'*[33].

3. Methods

3.1. Gathering data

Researchers surveyed from October 1, 2021, to November 30, 2021, targeting adult men and women aged 20 or older residing in Daegu and Gyeongbuk to investigate the awareness and use of wild vegetables and menus used wild vegetables. 420 questionnaires were distributed, 400 of which were collected(recovery rate 95.2%), and 386 copies were used as analysis data, excluding 14 questionnaires with insufficient responses.

Table 1. General characteristics of the subjects.

Variable	Content	N(%)
Gender	Male	169(43.8)
	Female	217(56.2)
Age	20-29	75(19.4)
	30-39	73(18.9)
	40-49	81(21.0)
	50-59	89(23.1)
	More than 60	68(17.6)
Total		386(100.0)

3.2. Data analysis

Based on previous studies[9][21], the questionnaire was modified to suit this study. The main survey used the questionnaire after conducting a preliminary survey from September 1 to September 20, 2021, to review the validity.

The survey consisted of questions about the perception, the degree of recognition, and the actual use of wild vegetables.

The recognition and knowledge of wild vegetable crops were measured using a 5-point Likert scale. Data analysis was performed using the SPSS 27.0 program. As for the wild vegetable items for the awareness survey of wild vegetables, 20 kinds of wild vegetables with high awareness and mainly growing naturally in the Gyeongbuk area were selected by referring to previous studies[4][27].

The utilization of wild vegetables was compared by calculating the frequency and percentage and then conducting the χ^2 test.

4. Results & Discussion

4.1. Perception of wild vegetable crops

As for the degree of recognition of wild vegetables, 'Wild vegetables have a unique scent and taste' was the highest at 4.25. For the following contents, the level of recognition was high with more than 4 points out of 5 points; 'Wild vegetables are health and natural food,' 'Wild vegetables have a good sense of season,' 'Wild vegetables are low-calorie foods high in dietary fiber,' 'Wild vegetables help control weight such as obesity.' The item' Wild vegetables are rich in physiologically active substances such as polyphenols' showed the lowest level of recognition at 3.82, but the overall score was higher than 3.5, indicating that the respondents were well aware of wild vegetables. <Table 2> shows the results of examining the recognition of wild vegetable crops by gender. Males were more knowledgeable than females about the items' Wild vegetables have a unique scent and taste' and 'Wild vegetables have a good sense of season.' Still, there was no significant difference between genders. In all other items, women showed higher recognition than men. In particular, there was a significant difference between genders at the p<0.05 level in 'Wild vegetables are rich in vitamins and minerals.'

Table 2. Recognition for wild vegetable crops by gender.

Contents	Gender		Total	T-value
	Male	Female		
Wild vegetables are rich in vitamins and minerals	3.91±0.68	4.06±0.73	3.99±0.71	-2.07*
Wild vegetables are low-calorie foods high in dietary fiber	4.02±0.73	4.10±0.71	4.07±0.72	-1.04
Wild vegetables are health and natural food	4.17±0.76	4.22±0.65	4.20±0.70	-0.75
Wild vegetables help control weight such as obesity	3.98±0.81	4.04±0.80	4.02±0.80	-0.71
Wild vegetables are rich in physiologically active substances such as polyphenols	3.75±0.78	3.88±0.79	3.82±0.79	-1.52
Wild vegetables help with metabolic syndrome such as high blood pressure and diabetes	3.88±0.75	3.96±0.76	3.93±0.76	-1.04
Wild vegetables have a unique scent and taste	4.27±0.74	4.24±0.69	4.25±0.71	0.42
The wild vegetables have a good sense of season	4.19±0.72	4.19±0.76	4.19±0.74	0.01
Wild vegetables have pharmacological effects such as anti-mutant, anti-cancer, and antibacterial effects	3.86±0.84	3.96±0.78	3.91±0.81	-1.19
Wild vegetables help improve immunity	3.92±0.82	4.05±0.80	3.99±0.81	-1.52

Note: *p<0.05.

<Table 3> shows the results of examining the recognition of wild vegetable crops by age. For the item 'Wild vegetables are rich in vitamins and minerals,' respondents in their 50s showed higher awareness than other age groups, but there was no significant difference. In the items' Wild vegetables are low-calorie foods high in dietary fiber' and 'Wild vegetables are health and natural food,' respondents in their 50s showed the highest level of awareness, and those over 60 years old showed the lowest. There was a significant difference between ages at the p<0.01 level. In the following items, respondents in their 50s indicated high awareness, but there was no significant difference; 'Wild vegetables help control weight such as obesity,' 'Wild vegetables are rich in physiologically active substances such as polyphenols, 'Wild vegetables help with

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metabolic syndromes such as high blood pressure and diabetes,' 'Wild vegetables have a good sense of season,' 'Wild vegetables have pharmacological effects such as anti-mutant, anti-cancer, and antibacterial effects,' 'Wild vegetables help improve immunity.'

In the category of 'Wild vegetables have a unique scent and taste,' respondents in their 50s scored the highest at 4.39, followed by those in their 30s and 40s. There was a significant difference between age groups(p<0.05>).

Table 3. Recognition for wild vegetable crops by age.

Contents	Age					Total	F-value
	20-29	30-39	40-49	50-59	Over 60 years of age		
Wild vegetables are rich in vitamins and minerals	4.03±0.69[a]	4.03±0.68[a]	3.99±0.73[a]	4.08±0.77[a]	3.79±0.63[a]	3.99±0.71	1.73
Wild vegetables are low-calorie foods high in dietary fiber	4.01±0.68[ab]	4.15±0.72[a]	4.06±0.78[a]	4.24±0.70[a]	3.82±0.64[b]	4.07±0.72	3.60[**]
Wild vegetables are health and natural food	4.21±0.66[a]	4.22±0.71[a]	4.21±0.78[a]	4.36±0.64[a]	3.93±0.65[b]	4.20±0.70	3.83[**]
Wild vegetables help control weight such as obesity	4.03±0.78[a]	4.07±0.80[a]	4.02±0.83[a]	4.10±0.88[a]	3.82±0.66[a]	4.02±0.80	1.30
Wild vegetables are rich in physiologically active substances such as polyphenols	3.79±0.75[a]	3.67±0.86[a]	3.83±0.84[a]	3.99±0.81[a]	3.79±0.61[a]	3.82±0.79	1.71
Wild vegetables help with metabolic syndrome such as high blood pressure and diabetes	3.93±0.79[a]	3.93±0.75[a]	3.95±0.80[a]	4.01±0.79[a]	3.78±0.64[a]	3.93±0.76	0.92
Wild vegetables have a unique scent and taste	4.23±0.83[a]	4.33±0.76[a]	4.25±0.66[a]	4.39±0.63[a]	4.00±0.64[b]	4.25±0.71	3.26[*]
The wild vegetables have a good sense of season	4.13±0.85[a]	4.10±0.83[a]	4.30±0.67[a]	4.33±0.67[a]	4.04±0.63[a]	4.19±0.74	2.23
Wild vegetables have pharmacological effects such as anti-mutant, anti-cancer, and antibacterial effects	3.89±0.84[a]	3.78±0.88[a]	3.96±0.81[a]	4.03±0.83[a]	3.87±0.64[a]	3.91±0.81	1.11
Wild vegetables help improve immunity	4.11±0.76[a]	3.84±0.92[a]	4.05±0.85[a]	4.09±0.84[a]	3.85±0.60[a]	3.99±0.81	1.97

Note: *p<0.05, **p<0.01.

4.2. Level of awareness for wild vegetable crops

As a result of the knowledge survey for wild vegetable crops, *'Artemisia princeps,' 'Capsella bursa-pastoris,' 'Aralia elata', 'Allium monanthum,' 'Aster scaber,'* and *'Sedum sarmentosum'* showed high awareness in the order. On the other hand, the awareness was low in the order of

'Heracleum moellendorffii,' 'Spergularia rubra,' 'Aster pseudoglehnii,' 'Amaranthus lividus,' 'Acanthopanax sessiliflorus,' and *'Cedred sinensis'*. It was found that wild vegetables with low intake experience had low awareness. <Table 4> shows the results of examining the knowledge of wild vegetable crops by gender. Awareness of 19 kinds of wild vegetables except for *'Capsella bursa-pastoris'* was higher in women than men, and among them, *'Amaranthus lividus'* and *'Spergularia rubra'* showed a significant difference(p<0.05).

Table 4. Knowledge for wild vegetable crops by gender.

Contents	Gender		Total	T-value
	Male	Female		
Artemisia princeps	4.04±0.81	4.18±0.74	4.12±0.77	-1.77
Aralia elata	3.90±0.84	4.01±0.82	3.96±0.83	-1.33
Sedum sarmentosum	3.50±1.15	3.61±1.08	3.56±1.11	-0.96
Aster scaber	3.57±1.03	3.66±1.07	3.62±1.05	-0.84
Amaranthus lividus	2.60±1.33	2.92±1.39	2.78±1.37	-2.24*
Ligularia fischeri	3.28±1.13	3.41±1.14	3.35±1.14	-1.12
Capsella bursa-pastoris	4.01±0.84	3.98±0.89	3.99±0.87	0.27
Peucedanum japonicum	2.95±1.35	3.12±1.21	3.04±1.27	-1.30
Ixerris dentata	2.93±1.22	3.18±1.18	3.07±1.20	-1.94
Aster pseudoglehnii	2.54±1.34	2.76±1.32	2.67±1.33	-1.61
Spergularia rubra	2.44±1.40	2.74±1.34	2.61±1.37	-2.14*
Allium monanthum	3.83±0.91	3.97±0.92	3.91±0.92	-1.47
Allium victorialis	3.70±0.96	3.81±1.03	3.76±1.00[a]	-1.04
Heracleum moellendorffii	2.25±1.27	2.45±1.34	2.37±1.31	-1.47
Pimpinella brachycarpa	3.36±1.12	3.40±1.18	3.38±1.15	-0.38
Angelica gigas	3.06±1.29	3.14±1.24	3.11±1.26	-0.64
Petasites japonicus	3.02±1.26	3.24±1.33	3.15±1.30	-1.66
Acanthopanax sessiliflorus	2.68±1.35	2.86±1.36	2.78±1.36	-1.26
Cedred sinensis	2.81±1.44	3.01±1.31	2.92±1.37	-1.44
Youngia sonchifolia	3.38±1.21	3.44±1.22	3.42±1.21	-0.46

Note: *p<0.05.

<Table 5> shows the results of examining the knowledge of wild vegetable crops by age. There was no significant difference between age groups for *'Artemisia princeps,'* and it was found to be the best-known among the surveyed wild vegetables(4.12 points of average). Relatively low knowledge of *'Aralia elata,' 'Sedum sarmentosum,'* and *'Aster scaber'* was shown in the 20s and 30s and increased with age, showing high awareness in the 50s,60s and older(p<0.001). There was a significant difference between age groups for *'Capsella bursa-pastoris'* and *'Peucedanum japonicum,'* showing the highest awareness in the 50s(p<0.001). The knowledge of *'Ixerris dentata,' 'Aster pseudoglehnii,'* and *'Spergularia rubra'* was the lowest in the 20s and the highest in the 60s and older. *'Allium monanthum'* showed the highest knowledge in the 50s, making a difference by age. *'Allium victorialis'* showed no difference between age groups. The knowledge of 'Pimpinella brachycarpa,' 'Angelica gigas,' 'Petasites japonicus,' 'Acanthopanax sessiliflorus,' 'Cedred sinensis,' and 'Youngia sonchifolia' was the lowest in the 20s and the highest in the 60s and older. As the age increased, their awareness also increased(p<0.001).

Table 5. Knowledge for wild vegetable crops by age.

Contents	Age					Total	F-value
	20-29	30-39	40-49	50-59	Over 60 years of age		
Artemisia princeps	4.11±0.86[a]	4.03±0.79[a]	4.10±0.78[a]	4.33±0.68[a]	4.00±0.73[a]	4.12±0.77	2.26
Aralia elata	3.89±0.90[bc]	3.64±0.88[c]	4.02±0.80[ab]	4.22±0.73[a]	3.97±0.73[ab]	3.96±0.83	5.34[***]
Sedum sarmentosum	2.87±1.22[c]	3.41±1.10[b]	3.59±1.11[ab]	3.94±0.98[a]	3.94±0.75[a]	3.56±1.11	13.76[***]
Aster scaber	3.24±1.17[b]	3.32±1.17[b]	3.51±1.05[b]	4.06±0.87[a]	3.93±0.77[a]	3.62±1.05	10.33[***]
Amaranthus lividus	1.89±1.06[c]	2.33±1.29[b]	2.62±1.36[b]	3.35±1.33[a]	3.69±0.93[a]	2.78±1.37	27.07[***]
Ligularia fischeri	2.95±1.15[b]	2.95±1.12[b]	3.21±1.17[b]	3.79±1.07[a]	3.84±0.82[a]	3.35±1.14	12.60[***]
Capsella bursa-pastoris	3.80±1.02[c]	3.74±0.97[c]	4.16±0.73[ab]	4.27±0.75[a]	3.91±0.76[bc]	3.99±0.87	5.82[***]
Peucedanum japonicum	2.31±1.23[c]	2.64±1.21[bc]	2.93±1.30[b]	3.53±1.16[a]	3.79±0.80[a]	3.04±1.27	20.74[***]
Ixerris dentata	2.41±1.07[d]	2.66±1.15[d]	3.06±1.14[c]	3.42±1.22[b]	3.79±0.83[a]	3.07±1.20	18.61[***]
Aster pseudoglehnii	1.77±1.00[c]	2.21±1.19[b]	2.48±1.19[b]	3.28±1.35[a]	3.57±0.98[a]	2.67±1.33	30.83[***]
Spergularia rubra	1.77±1.11[c]	2.12±1.25[bc]	2.44±1.32[b]	3.17±1.32[a]	3.51±1.07[a]	2.61±1.37	25.68[***]
Allium monanthum	3.64±1.14[c]	3.68±0.99[c]	4.04±0.79[ab]	4.20±0.75[a]	3.90±0.75[bc]	3.91±0.92	5.58[***]
Allium victorialis	3.55±1.30[a]	3.63±1.03[a]	3.81±0.89[a]	3.97±0.88[a]	3.82±0.79[a]	3.76±1.00[a]	2.25
Heracleum moellendorffii	1.80±0.94[c]	2.00±1.19[c]	1.96±1.07[c]	2.82±1.48[b]	3.26±1.15[a]	2.37±1.31	21.00[***]
Pimpinella brachycarpa	3.16±1.19[cd]	2.92±1.15[d]	3.33±1.14[bc]	3.65±1.20[ab]	3.82±0.79[a]	3.38±1.15	7.87[***]
Angelica gigas	2.59±1.15[b]	2.68±1.23[b]	2.94±1.25[b]	3.60±1.26[a]	3.69±0.93[a]	3.11±1.26	14.26[***]
Petasites japonicus	2.51±1.36[c]	2.71±1.25[bc]	2.96±1.27[b]	3.66±1.20[a]	3.87±0.77[a]	3.15±1.30	18.39[***]
Acanthopanax sessiliflo-rus	2.05±1.16[d]	2.47±1.31[c]	2.60±1.38[c]	3.18±1.37[b]	3.60±0.97[a]	2.78±1.36	17.20[***]
Cedred sinensis	2.00±1.16[d]	2.40±1.29[c]	2.94±1.45[b]	3.48±1.20[a]	3.76±0.86[a]	2.92±1.37	26.83[***]
Youngia sonchifolia	3.12±1.27[c]	3.04±1.21[c]	3.32±1.32[bc]	3.65±1.16[ab]	3.96±0.78[a]	3.42±1.21	7.64[***]

Note:[***]$p<0.001$.

4.3. Utilization for wild vegetable crops

<Table 6> shows the results of examining the utilization of wild vegetable crops by gender. For examining the utilization of wild vegetables, purchase motivation, purchase considerations, purchase purpose, purchase place, purchase frequency, and purchase reason were investigated with items. As for the motive for purchasing wild vegetables, males had the highest with 'rec-ommendation from family, friends, and neighbors' at 44.9%, while females had the highest with 'good for health' at 50.7%, but there was no significant difference. As considerations for pur-chase, both men and women appeared in the order of 'freshness,' 'taste,' and 'eco-green,' there was no significant difference between genders. For the purchase purpose, both men and women purchased wild vegetables in the order of 'for side dishes,' 'for bibimbap,' and 'for salads.' In the purchase place, both men and women were in the order of 'traditional markets,' 'large dis-count stores & department stores.' Regarding the purchase frequency, '1-2 times a month' was the most frequent for both men and women. In 'others(3-4 times a year)', males accounted for 21.9% and females 15.7%, indicating that males did not purchase more often than females. For purchase reasons, men were in the order of 'for good health,' 'good taste,' and 'traditional food,' while women were in the order of 'for good health,' 'good taste,' and 'use in a variety of foods.'

Table 6. Utilization for wild vegetable crops by gender.

Variable	Content	Gender		Total	χ²
		Male	Female		
Motivation for purchase	Good for health	70(41.4)	110(50.7)	180(46.6)	8.491 (df=4)
	Family, friends, and neighbors	76(44.9)	87(40.1)	163(42.2)	
	Salesperson's recommendation	6(3.6)	5(2.3)	11(2.8)	
	Mass media	14(8.3)	7(3.2)	21(5.4)	
	Others	3(1.8)	8(3.7)	11(2.8)	
	Total	169(100.0)	217(100.0)	386(100.0)	
Consideration of purchasing or eating	Taste	56(33.1)	65(29.9)	121(31.3)	3.081 (df=5)
	Price	10(5.9)	11(5.1)	21(5.4)	
	Freshness	60(35.5)	95(43.8)	155(40.2)	
	Packaging and design	2(1.2)	2(0.9)	4(1.0)	
	Eco green	40(23.7)	42(19.4)	82(21.2)	
	Others	1(0.6)	2(0.9)	3(0.8)	
	Total	169(100.0)	217(100.0)	386(100.0)	
Purpose of purchase	For salads	15(8.9)	16(7.4)	31(8.0)	8.404 (df=6)
	For bibimbap	51(30.1)	5(2.3)	108(28.0)	
	For green juice	1(0.6)	2(0.9)	3(0.8)	
	For decoration	1(0.6)	1(0.4)	2(0.5)	
	For side dishes	96(56.8)	141(65.0)	237(61.4)	
	For fermented liquid	1(0.6)	0(0.0)	(0.3)	
	Others	4(2.4)	0(0.0)	4(1.0)	
	Total	169(100.0)	217(100.0)	386(100.0)	
Place of purchase	Traditional market	65(38.5)	87(40.1)	152(39.4)	5.042 (df=4)
	Large discount stores & department stores	52(30.8)	80(36.9)	132(34.2)	
	Directly from the production area	29(17.1)	34(15.6)	63(16.3)	
	Home shopping & Internet shopping malls	13(7.7)	8(3.7)	21(5.4)	
	Forest cooperative	10(5.9)	8(3.7)	18(4.7)	
	Total	169(100.0)	217(100.0)	386(100.0)	
Frequency of purchase	1-2 times a month	103(61.0)	135(62.2)	238(61.7)	6.528 (df=4)
	1-2 times a week	19(11.2)	30(13.8)	49(12.7)	
	2 times a week	9(5.3)	10(4.6)	19(4.9)	
	More than three times a week	1(0.6)	8(3.7)	9(2.3)	
	Others	37(21.9)	34(15.7)	71(18.4)	
	Total	169(100.0)	217(100.0)	386(100.0)	
Reasons for purchase	Good taste	43(25.4)	38(17.5)	81(21.0)	3.711 (df=4)
	For good health	83(49.1)	129(59.5)	212(54.9)	
	Familiar taste	10(5.9)	14(6.5)	24(6.2)	
	Use in a variety of foods	7(4.2)	17(7.8)	24(6.2)	
	Simple recipe	4(2.4)	8(3.7)	12(3.1)	
	Traditional food	20(11.8)	9(4.1)	29(7.5)	
	Others	2(1.2)	2(0.9)	4(1.0)	
	Total	169(100.0)	217(100.0)	386(100.0)	

<Table 7> shows the results of examining the utilization of wild vegetable crops by age. As a motivation for purchasing wild vegetables, 'recommendation from family, friends, and neigh-bors' was relatively high among respondents in their 20s and 30s, while 'good for health' was higher in their 40s, 50s, 60s, and older. There was a significant difference between age

groups(p<0.001). For purchase consideration, 61.3% of the 20s considered 'freshness' the most. In the 30s, 40s, 50s, 60s, and older, 'freshness,' 'taste,' and 'eco-friendly' were considered in order. There was a significant difference between age groups(p<0.05). For purchase purposes, 'for salads' was the highest at 15.1% in the 30s, and 'for bibimbap' was 42.6% in the 60s and older. Most respondents did not use wild vegetables for 'green juice' and 'decoration.' 'For side dishes' was 70.4% in their 40s, the highest among all age groups(p<0.05). As for the place of purchase, respondents in their 20s and 30s mostly purchased at 'large discount stores and department stores,' while those in their 40s, 50s, 60s, and older mostly purchased at 'traditional markets.' There was a significant difference between ages(p<0.001). Regarding the purchase frequency, respondents of 75.0% in the 60s and older purchased '1-2 times a month'. Purchases of 'once a week' were in the order of 20s(17.3%) and 40s(14.8%). 'Others' was the highest at 24.7% in their 30s.

For purchase reasons, respondents in their 20s were in the order of 'for good health,' 'good taste,' and 'use in a variety of foods.'

In their 30s to 50s, the order was 'for good health,' 'good taste,' and 'traditional food.' In their 60s and older, the order was 'for good health,' 'good taste,' and 'familiar taste.' There was no significant difference.

Table 7. Utilization for wild vegetable crops by age.

Variable	Content	Age					Total	χ²
		20-29	30-39	40-49	50-59	Over 60		
Motivation for purchase	Good for health	14(18.7)	21(28.8)	49(60.5)	53(59.6)	43(63.2)	180(46.6)	74.440*** (df=16)
	Family, friends, and neighbors	57(76.0)	40(54.8)	22(27.2)	25(28.1)	19(27.9)	163(42.2)	
	Salesperson's recommendation	0(0.0)	3(4.1)	2(2.5)	3(3.4)	3(4.4)	11(2.8)	
	Mass media	2(2.7)	8(11.0)	5(6.2)	4(4.5)	2(2.9)	21(5.4)	
	Others	2(2.7)	1(1.4)	3(3.7)	4(4.5)	1(1.5)	11(2.8)	
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)	
Consideration of purchasing or eating	Taste	22(29.3)	24(32.9)	23(28.4)	31(34.8)	21(30.9)	121(31.3)	34.544* (df=20)
	Price	1(1.3)	6(8.2)	5(6.2)	3(3.4)	6(8.8)	21(5.4)	
	Freshness	46(61.3)	26(35.6)	30(37.0)	31(34.8)	22(32.4)	155(40.2)	
	Packaging and design	1(1.3)	2(2.7)	0(0.0)	1(1.1)	0(0.0)	4(1.0)	
	Eco green	4(5.3)	15(20.5)	22(27.2)	22(24.7)	19(27.9)	82(21.2)	
	Others	1(1.3)	0(0.0)	1(1.2)	1(1.1)	0(0.0)	3(0.8)	
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)	
Purpose of purchase	For salads	8(10.7)	11(15.1)	3(3.7)	4(4.5)	5(7.4)	31(8.0)	37.226* (df=24)
	For bibimbap	16(21.3)	21(28.8)	20(24.7)	22(24.7)	29(42.6)	108(28.0)	
	For green juice	0(0.0)	0(0.0)	1(1.2)	1(1.1)	1(1.5)	3(0.8)	
	For decoration	1(1.3)	1(1.4)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	
	For side dishes	50(66.7)	39(53.4)	57(70.4)	59(66.3)	32(47.1)	237(61.4)	
	For fermented liquid	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(1.5)	1(0.3)	
	Others	0(0.0)	1(1.4)	0(0.0)	3(3.4)	0(0.0)	4(1.0)	
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)	

Place of purchase	Traditional market	22(29.3)	17(23.3)	40(49.4)	38(42.7)	35(51.5)	152(39.4)
	Large discount stores & department stores	40(53.3)	35(47.9)	25(30.9)	20(22.5)	12(17.6)	132(34.2)
	Directly from the production area	5(6.7)	9(12.3)	9(11.1)	22(24.7)	18(26.5)	63(16.3)
	Home shopping & internet shopping malls	2(2.7)	9(12.3)	5(6.2)	4(4.5)	1(1.5)	21(5.4)
	Forest cooperative	6(8.0)	3(4.1)	2(2.5)	5(5.6)	2(2.9)	18(4.7)
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)
Frequency of purchase	1-2 times a month	43(57.3)	44(60.3)	47(58.0)	53(59.6)	51(75.0)	238(61.7)
	1-2 times a week	13(17.3)	9(12.3)	12(14.8)	8(9.0)	7(10.3)	49(12.7)
	2 times a week	5(6.7)	1(1.4)	4(4.9)	7(7.9)	2(2.9)	19(4.9)
	More than three times a week	1(1.3)	1(1.4)	1(1.2)	4(4.5)	2(2.9)	9(2.3)
	Others	13(17.3)	16(24.7)	17(21.0)	17(19.1)	6(8.8)	71(18.4)
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)
Reasons for purchase	Good taste	13(17.3)	19(26.0)	16(19.8)	17(19.1)	16(23.5)	81(21.0)
	For good health	37(49.3)	38(52.1)	48(59.3)	55(61.8)	34(50.0)	212(54.9)
	Familiar taste	6(8.0)	4(5.5)	4(4.9)	4(4.5)	6(8.8)	24(6.2)
	Use in a variety of foods	9(12.0)	3(4.1)	5(6.2)	4(4.5)	3(4.4)	24(6.2)
	Simple recipe	4(5.3)	3(4.1)	1(1.2)	0(0.0)	4(5.9)	12(3.1)
	Traditional food	3(4.0)	6(8.2)	7(8.6)	8(9.0)	5(7.4)	29(7.5)
	Others	3(4.0)	0(0.0)	0(0.0)	1(1.1)	0(0.0)	4(1.0)
	Total	75(100.0)	73(100.0)	81(100.0)	89(100.0)	68(100.0)	386(100.0)

The rightmost column of the table shows chi-square values: Place of purchase: 60.294*** (df=16); Frequency of purchase: 17.963 (df=16); Reasons for purchase: 27.961 (df=24).

5. Conclusion

Researchers began this study to prepare basic data that can be used in various food manufacturing fields in the future through a survey of awareness and usage of edible wild vegetables that require the development of processed wild plants. As for the degree of recognition of wild vegetables, 'Wild vegetables have a unique scent and taste' was the highest at 4.25. For the following contents, the level of recognition was high with more than 4 points out of 5 points; 'Wild vegetables are health and natural food,' 'Wild vegetables have a good sense of season,' 'Wild vegetables are low-calorie foods high in dietary fiber,' 'Wild vegetables help control weight such as obesity.' As a result of the knowledge survey for wild vegetable crops, 'Artemisia princeps,' 'Capsella bursa-pastoris,' 'Aralia elata', 'Allium monanthum,' 'Aster scaber,' and 'Sedum sarmentosum' showed high awareness in the order. On the other hand, the awareness was low in the order of 'Heracleum moellendorffii,' 'Spergularia rubra,' 'Aster pseudoglehnii,' 'Amaranthus lividus,' 'Acanthopanax sessiliflorus,' and 'Cedred sinensis'. It was found that wild vegetables with low intake experience had low awareness. In examining the utilization of wild vegetable crops, regarding purchase motivation, 'good for health' was high at 46.6%, and 'recom-

mendation from family, friends, and neighbors ' followed at 42.2%. As considerations for purchase, respondents responded in the order of 'freshness(40.2%),' 'taste(31.3%),' and 'eco-friendly(21.2%).'

For the purchase purpose, 'for side dishes(Namul)' was highest at 61.4%, and 'for bibimbap' followed at 28.0%. In the purchase place, 'traditional markets' was 39.4%, 'large discount stores & department stores' was 34.2%, and 'directly from the production area' was 16.3%. 'Forest cooperative' was the lowest at 4.7%. Regarding the purchase frequency, '1-2 times a month' was the most frequent at 61.7%. '1-2 times a week' was 12.7%, and 'others(3-4 times a year)' was 18.4%. For purchase reasons, respondents were in the order of 'for good health(54.9%),' 'good taste(21.0%),' and 'traditional food(7.5%).'

The implications of this study's results are as follows. By investigating consumers' use and awareness of wild vegetables, the survey data can be used for distribution and marketing plans for edible wild vegetables, which are special forest products.

In addition, the research results on the purchase purpose of wild vegetables, the actual use of wild vegetable products, and the degree of preference provide basic data for developing high-added-value products by using them in various processed foods and menu development.

6. References

6.1. Journal articles

[1] Lee EY & Yeo GE & Lee JO & Jeon YH & Cho MS & Oh JE. Style for the Consumer's Awareness and Purchase Behavior about the Forest Product. *The Journal of the Korea Contents Association,* 20(11), 77-87 (2020).

[2] Min KT & Koo JC & Kim ME. Consumer's Recognition on Naturally-grown Forest Products. *Journal of Korean Forest Society*, 104(4), 668-676 (2015).

[3] Cho EJ. A Survey on the Usage of Wild Grasses. *Journal of the Korean Society of Dietary Culture,* 15(1), 59-68 (2000).

[4] Byun SY & Seok HD. An Analysis of Consumer Preference and Demand for Wild Vegetables: Through a Consumer Preference Survey and Social Big Data Analysis. *Journal of Korean Society of Forest Science,* 108(1), 116-126 (2019).

[5] Hwang EG & Kim SJ & Kim BK. Effects of the Characteristics of Wild Vegetables on Customer Satisfaction, Trust and Repurchase Intention. *Culinary Science and Hospitality Research,* 20(4), 59-74 (2014).

[6] Yoo HJ & Song EG. Plans to Help Forestry Households Overcome Their Crisis through Their Linkage to a 6th Industry in South Korea. *International Journal of Human & Disaster*, 2(2), 23-26 (2017). [**Read More**]

[7] Kim MS & Hong WS. The Study on Consumer Perception and Consumer Demand of Product with Aster Yomena. *Journal of the Korean Society of Dietary Culture*, 35(3), 256-264 (2020).

[8] Park YJ & Kim RC & Bae JH & Cho JY & Chon SU & Kim HJ & Heo BG. Recognition Examination on the Edible Native Wild Vegetables of University Students. *Journal of People Plants and Environment*, 8(4), 106-113 (2005).

[9] Lee YM & Bae JH & Jung HY & Kim JH & Park DS. Antioxidant Activity in Water and Methanol Extracts from Korean Edible Wild Plants. *Journal of the Korean Society of Food Science and Nutrition*, 40(1), 29-36 (2011).

[10] Lee J & Kwon G & Cheon W & Lim W. A Study on the Revitalization of Forest Management by Improving the Implementation Rate of Forest Projects. *International Journal of Human & Disaster*, 5(2), 1-9 (2020). [**Read More**]

[11] Yoo HJ & Song EG. The Crisis of Forestry in South Korea and Its Future Direction. *International Journal of Human & Disaster*, 3(2), 14-17 (2018). [**Read More**]

[12] Park ID. Quality Characteristics and Antioxidant Activity Prepared from Taraxacum Coreanun Powder. *The Korean Journal of Food and Nutrition*, 34(4), 415-422 (2021).

[13] Singleton VL & Orthofer R & Lamuela-Raventos RM. Analysis of Total Phenols and Other Oxidation Substrates and Antioxidants by Means of Folin-ciocalteu Reagent. *Methods in Enzymology*, 299, 152-178 (1999).

[14] Lee GE & Park SJ & Jung YK & Go GB & Son BG & Jeong JS. Preparation and Quality Characteristics of Namul-kim Bugak using Aster Yomena. *Korean Journal of Food and Cookery Science*, 32(1), 50-57 (2016).

[15] Park MH. Antioxidant Activity and Quality Characteristics of Cookies Prepared with Houttuynia Cordata Thunb Powder. *Culinary Science and Hospitality Research*, 27(10), 70-79 (2021).

[16] Kwon GS & Cheon WK & Lim WH. A Study on the Actual Condition and Improvement Plan of Hierarchical Safety Management in Natural Parks. *International Journal of Crisis & Safety*, 5(1), 21-34 (2020). [Read More]

[17] Yoon HS & Kim JW & Kim SH & Kim YG & Eom HJ. Quality Characteristics of Bread Added with Aronia Powder. *Journal of the Korean Society of Food Science and Nutrition*, 3(2), 273-280 (2014).

[18] Yoo YS & Lee MH. Quality Characteristics and Antioxidant of Pan-bread Prepared with Cacao Nibs Powder. *Culinary Science & Hospitality Research*, 26(11), 84-96 (2020).

[19] Jeon MJ & Park JS & Lim WH. An Investigation on Developing the Shelter and Safety Facilities of Forest Kindergartens. *International Journal of Protection, Security & Investigation*, 5(1), 42-53 (2020). [Read More]

[20] Choi YH & Cho SS. Quality Characteristics of Sulgidduk with Different Amount of Dried Peucedanum Japonicum Powder. *Culinary Science and Hospitality Research*, 24(9), 67-75 (2018).

[21] Lee SL & Joo SY. Effects of Premature Mandarin Powder on the Quality Characteristics and Antioxidant Activities of Scone. *Korean Journal of Food Preservation*, 28(2), 231-239 (2021).

[22] Kim C & Lee H & Lim W. Improvement Plan through Nonagreement Consultation Analysis of Small Scale Environmental Impact Assessment. *Public Value*, 6(1), 1-13 (2021). [Read More]

[23] Lee MS & Chung MS. Analysis of Volatile Flavor Components of Aster Glehni. *Korean Journal of Food and Cookery Science*, 14(5), 547-552 (1998).

[24] Yang JS & Kim JS. Optimization of Scone Added with Extracted Peach Liquid. *Culinary Science & Hospitality Research*, 25(8), 145-151 (2019).

[25] Kang YC & Choi KK & Kim KH & Kim HK. Microencapsulation of Aster Scaber and Aster Glehni by Spray Drying. *Korean Journal of Food Preservation*, 9(2), 212-220 (2002).

[26] Baek JP. Comparisons of Concentration in Functional and Volatile Components of Several Wild Baby Vegetables. *Journal of Agricultural, Life and Environmental Sciences*, 32(1), 11-19 (2020).

[27] Kim GT. A Comparison of Photosynthetic Characteristics of Three Ligularia Species Under-tree Cultivation. *Korean Journal of Plant Resources*, 21(5), 357-361 (2008).

[28] Jeong JH & Lim MK & Lee SY. Synergistic Effects Exerted by the Combination of Aster Glehni and Vitamin B Complex on Cognitive Improvement. *Journal of the Korean Society of Food Science and Nutrition*, 51(6), 523-530 (2022).

[29] Agung N & Kim MH & Lee JH & Kim JD & Lee KR & Choi JS & Yoo YM & Park HJ. Polyphenol Analysis and Peroxynitrite Scavenging Effect of the Extracts from Eight Korean Mountainous Vegetable. *Korean Journal of Pharmacognosy*, 42(1), 38-45 (2011).

[30] Lee HJ & Cheon WK & Lim WH. A Study of Prediction on the Species Number and Naturalization Index of Land Naturalized Plants. *International Journal of Human & Disaster*, 5(1), 10-23 (2020). [Read More]

[31] Choi HN & Kang SJ & Choe EO & Chung LN & Kim JI. Research Articles: Antioxidant Effects of Sanchae-namul in Mice Fed High-fat and High-sucrose Diet. *Korean Journal of Food and Cookery Science*, 30(4), 369-377 (2014).

[32] Woo SL & Lee MH. Quality Characteristics and Antioxidant of Pan Bread Prepared with Mugwort Powder. *Culinary Science & Hospitality Research*, 27(10), 153-162 (2021).

[33] Kim EM & Kim GH. Physicochemical and Sensory Characteristics of Aster Glehni Kimchi during Storage at Different Fermentation Temperatures. *Korean Journal of Food and Cookery Science*, 20(1), 11-16 (2004).

7. Appendix

7.1. Author's contribution

	Initial name	Contribution
Lead Author	JP	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	CK	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	WL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

International Journal of Crisis & Safety

A Study on Street Tree Maintenance: Focusing on Suseong-gu, Daegu in South Korea

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Abstract

Purpose: In urban society, street trees are closely related to our lives. However, many people do not recognize the existence and necessity of street trees on ordinary days. This study investigated the changes in the growth of street trees exposed to environmental damage and artificial management due to street maintenance. This paper aims to provide necessary data for street tree management by analyzing changes in the growth of street trees according to the road size in terms of temporal change and management of street trees.

Method: Field surveys were conducted from June to September 2021 to identify the direction of maintenance for street trees by road size. The researchers collected and analyzed data on street tree roads and basic plan data on street trees in Suseong-gu in 1997. This paper conducted One-way ANOVA by six items(tree height, root-collar diameter, crown width, diameter at breast height, degree of tree health, and degree of environmental damage). Microsoft Office Excel 2007 program and Spss Statistics 21 statistical program were used for statistical analysis.

Results: As a result of analyzing the current state of street trees in 2021 and the change amount by road size in 1997 data, on average, the tree height increased by 5.4m, the root-collar diameter increased by 22.3cm, the crown width increased by 2.1m, and the diameter at breast height increased by 12.8cm. The degree of tree health decreased by 0.2 points, and the degree of environmental damage decreased by 1.1 points.

Conclusion: The tree form of street trees did not have a natural tree shape due to artificial management, and street trees were damaged due to lack of management and damage from surrounding shops. The analysis results show that the appearance of street trees has grown, but street trees' growth aspects(tree health, environmental damage) have regressed due to incorrect pruning work with tall trees according to laws and ordinances. This paper suggests that street trees' species selection and improvement supplement work should be done through continuous research in the future, and systematic and efficient management should be continuously carried out for satisfaction with street trees and pedestrians.

Keywords: Street Trees, Roads, Tree Form, Degree of Tree Health, Degree of Environmental Damage

1. Introduction

In urban society, street trees are very closely related to our lives. From 8-lane roads to 2-lane alleys, there are few roads without street trees planted[1]. However, many people need to recognize the existence and necessity of street trees on ordinary days[2][3]. Street trees benefit our lives by providing greenery to roads, preventing noise, and purifying air quality of smoke and fine dust[4][5]. In daily life, roadside trees often receive attention when they cause inconveniences such as car accidents on roads, damage to sidewalks caused by the uplift of tree roots,

*This paper summarizes Hyunjung Um's Daegu Haany University Master's Thesis.

unpleasant odors from fallen leaves or fruits, pests, and covering signboards in commercial facilities[6][7][8].

Rapid economic growth since the 1970s has brought the benefits of material abundance to people's lives[9][10]. Still, this growth resulted in the urbanization phenomenon of the increase in traffic volume, the expansion of roads, and the expansion of cities[11][12]. The environment within cities has deteriorated rapidly due to the excessive concentration of population and industry[13][14]. Accordingly, people prepared street trees to introduce nature into urban spaces[15][16]. In ancient Egyptian hieroglyphics, the shape of streets was drawn with two horizontal lines to represent roads[17]. The shape of roadside trees was drawn like three trees planted along vertical lines, proving that the relationship between roads and roadside trees had existed since ancient times[18][19][20].

In Korea, the first street tree to appear in documents was in the 2nd year of King Gojong(1895). The content of the papers was that the Naemu Amun Government Office instructed to plant trees on each province's left and right sides of roads[7][21][22]. The most easily accessible green spaces around us are trees planted along streets and roadsides for 'land greening, landscape creation, and pollution prevention'[7][23]. In Korea, street trees are defined as one of the appendages of roads with the enactment of the Road Act in 1961. Street trees have a long history, so many studies have been conducted on various planting and management methods[7][24][25][26].

Some papers are 'A study on urban roadside tree management considering the tree growth environment'[9], 'A study on the national street tree management status and improvement plans in Korea'[23], 'Tree shape and bark type characteristics of landscape trees in Korea'[4], 'Street trees in Gumi City A study on planting analysis and improvement plans'[27], 'A survey on the status of street trees and public awareness for improving the street environment in Dong-gu, Daegu'[1], 'A study on the current status and analysis of street trees in Korea'(Hong EG, 2003), and 'Street environment Effects on the growth of street trees'[27][28][29].

Studies on roadside trees have mainly focused on the current state of roadside trees, surveys on citizens' perceptions of roadside trees, and management plans through analysis of roadside tree species[23][30][31][32].

Researchers of this paper recognized that there should be changes in the growth environment of street trees according to changes of the times, but there were few significant changes. So, the researchers tried to find the cause and solutions through investigation. This study investigated the changes in the growth of street trees exposed to environmental damage and artificial management due to street maintenance in 2021, 20 years later, referring to data from 1997. This paper aims to provide necessary data for street tree management by analyzing changes in the growth of street trees according to the road size in terms of temporal change and management of street trees.
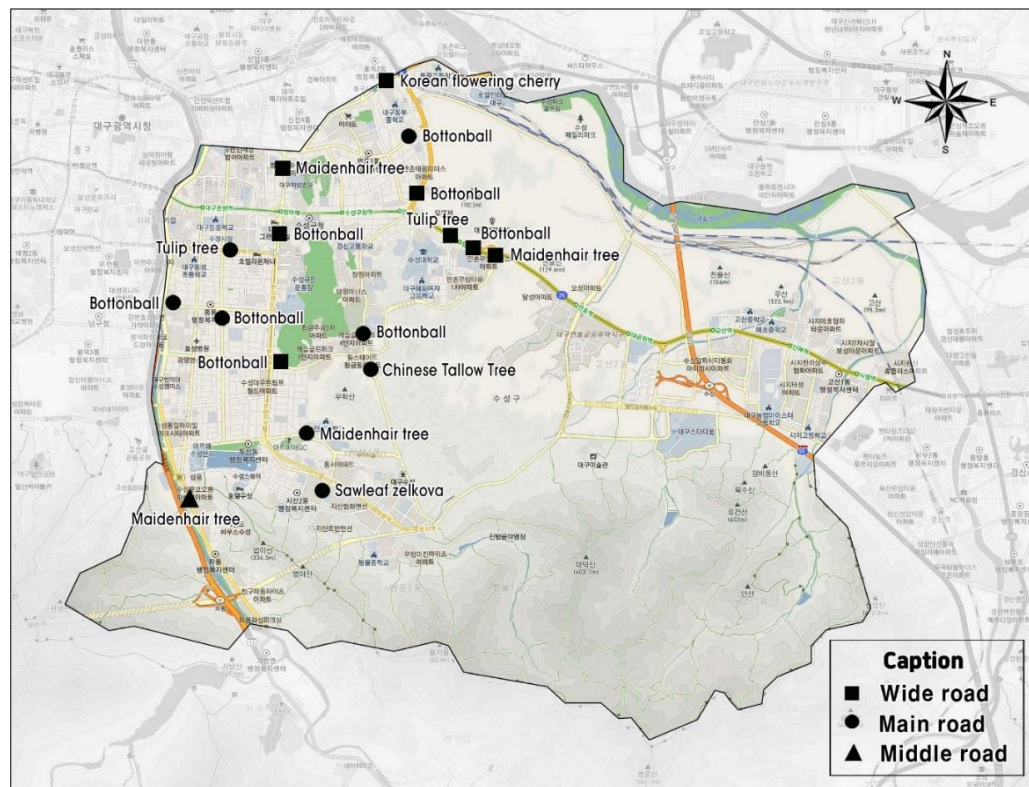
2. Methods

2.1. Gathering data

In this study, 14 routes were surveyed from June 2021 to September 2021 to analyze the growth environment and management status of street trees in Daegu. The researchers of this paper investigated 6 items for 4 months, including tree height, root-collar diameter, crown width, diameter at breast height, degree of tree health, and degree of environmental damage of a total of 900 trees <Table 1>.

Table 1. Number of studied subjects.

Research scope	Number of studied routes	Number of studied trees
Wide road	5	400
Main road	7	400
Middle road	2	100
Total	14	900

Figure 1. Location map of the studied sites.

2.2. Data analysis

Field surveys were conducted from June to September 2021 to identify the direction of maintenance for street trees by road size. The researchers collected and analyzed data on street tree roads and basic plan data on street trees in Suseong-gu in 1997. In this paper, one-way ANOVA was conducted by dividing six items(tree height, root-collar diameter, crown width, diameter at breast height, degree of tree health, and degree of environmental damage) into past and present data for each route. Microsoft Office Excel 2007 program and Spss Statistics 21 statistical program were used for statistical analysis.

Table 2. Contents of investigation and analysis by item category.

Item category	Contents of investigation and analysis
Tree height	- Tree height measurement using the Suunto height meter
Root-collar diameter	- Measurement of the root part from the above-ground part using calipers

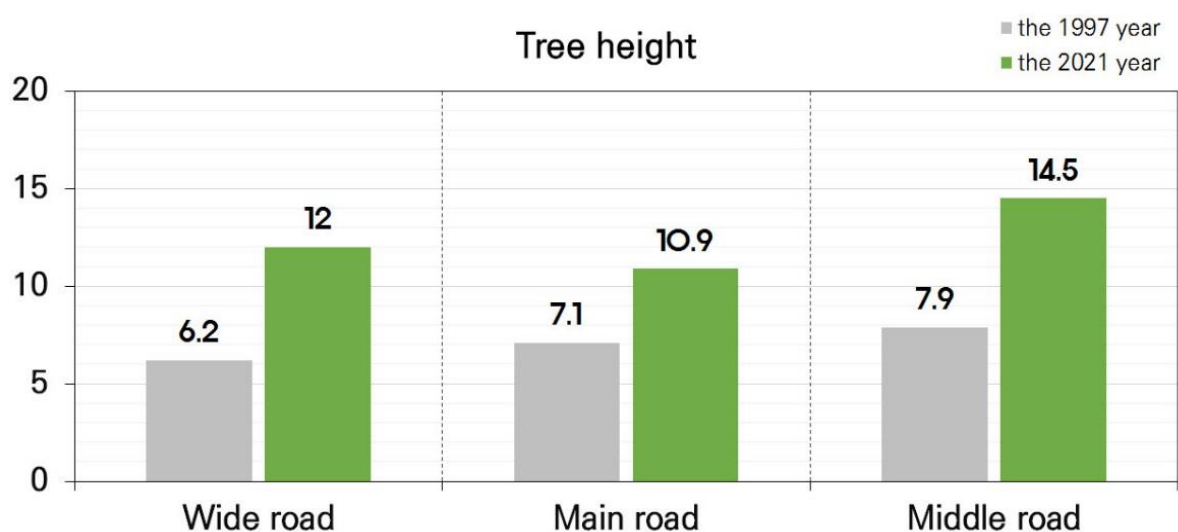|	
Crown width	- Length of tree crown from start point to end point - Measurement using a handcart wheel length meter
Diameter at breast height	- Measurement at breast height using calipers - Measurement at a point of approximately 1.2 m above the ground
Degree of tree health	- The evaluation standard table mainly used by the national institute of forest science of the Korea forest service
Degree of environmental damage	- The evaluation standard table mainly used by the national institute of forest science of the Korea forest service

3. Results & Discussion

3.1. Analysis of the amount of change in tree height

<Table 3> shows the results of the analysis of the amount of change at tree height in 1997 and 2021 for wide, main, and middle roads. The trees grew in tree height by 5.9m from 6.2m to 12.0m on the wide roads, by 3.8m from 7.1m to 10.9m on the main roads, and by 6.6m from 7.9m to 14.5m on the middle roads. The average tree height by road size increased by 5.4m, and the difference in tree height appeared the most on the middle road. Researchers of this paper analyzed that the ginkgo trees on Padong-ro in the middle road have favorable conditions for the growth of street trees due to the low surrounding buildings. <Figure 2> shows a comparison bar graph of the amount of change at tree height in 1997 and 2021 by road size.

Table 3. Analysis of the amount of change in tree height by road size.

(Unit: m)

Road size	Number of investigations	Tree height		Increase or decrease
		The 1997 year	The 2021 year	
Wide road	400	6.2	12.0	△5.9
Main road	400	7.1	10.9	△3.8
Middle road	100	7.9	14.5	△6.6
Average		7.1	12.5	△5.4

Figure 2. Comparison graph of the change amount at tree height in 1997 and 2021 by road size.

3.2. Analysis of the amount of change in root-collar diameter

<Table 4> shows the results of the analysis of the amount of change at root-collar diameter in 1997 and 2021 for wide, main, and middle roads.

The trees grew in root-collar diameter by 17.5cm from 28.7cm to 46.2cm on the wide roads and by 27.0cm from 21.9cm to 49.0cm on the main roads. Data for 1997 at the root-collar diameter on the middle roads did not exist, so the amount of change could not be shown.
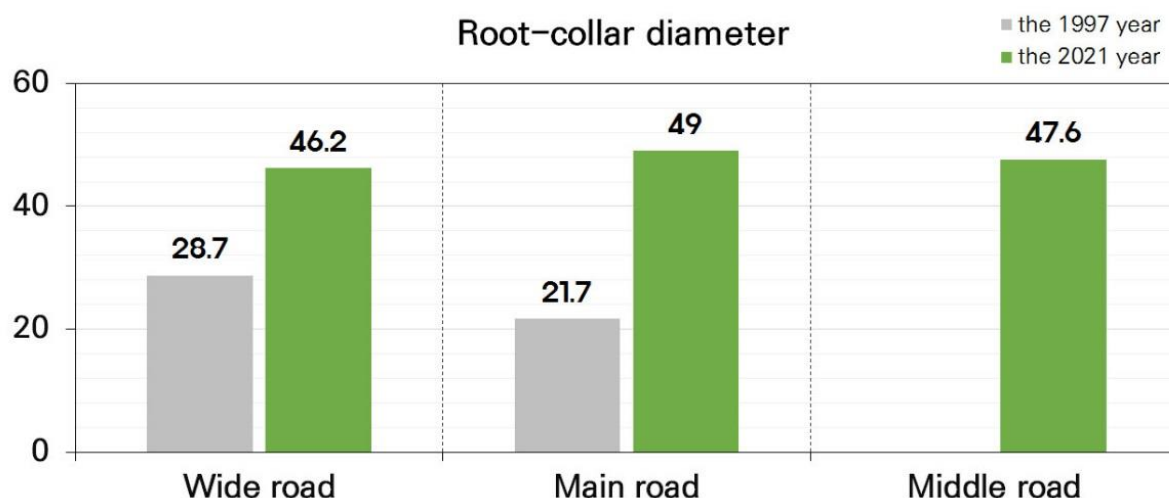
The average root-collar diameter by road size increased by 22.3cm, and the difference in root-collar diameter appeared the most on the main road. The researchers analyzed that the American sycamore on the main roads has the characteristics of active volume growth and rapid growth. <Figure 3> shows a comparison bar graph of the amount of change at root-collar diameter in 1997 and 2021 by road size.

Table 4. Analysis of the amount of change in root-collar diameter by road size.

(Unit: m)

Road size	Number of investigations	Root-collar diameter		Increase or decrease
		The 1997 year	The 2021 year	
Wide road	400	28.7	46.2	△17.5
Main road	400	21.7	49.0	△27.1
Middle road	100	-	47.6	-
Average		25.3	47.6	△22.3

Figure 3. Comparison graph of the change amount at root-collar diameter in 1997 and 2021 by road size.
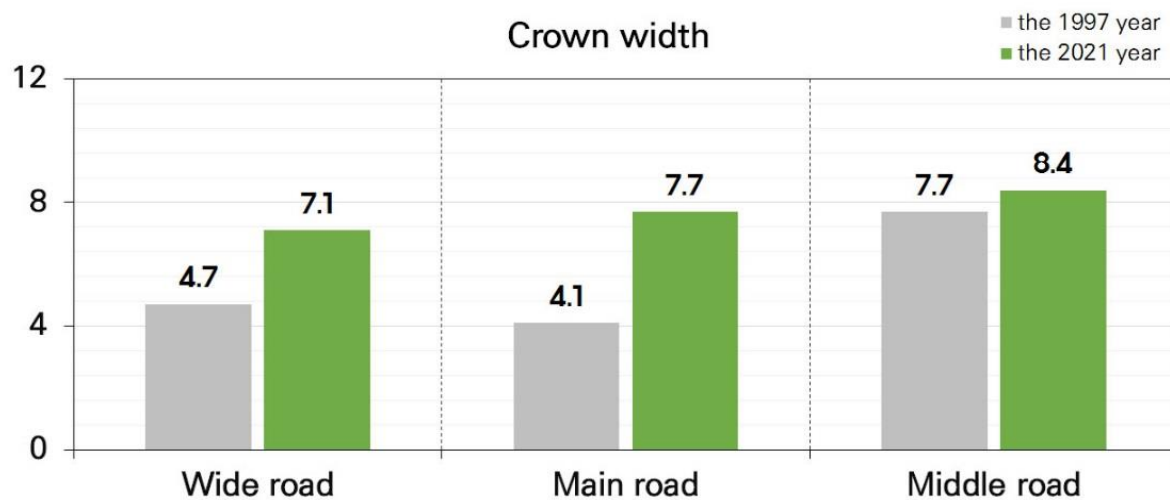

3.3. Analysis of the amount of change in crown width

<Table 5> shows the results of the analysis of the amount of change in crown width in 1997 and 2021 for wide, main, and middle roads. The trees grew in crown width by 2.4m from 4.7m to 7.1m on the wide roads, by 3.6m from 4.1m to 7.7m on the main roads, and by 0.7m from 7.7m to 8.4m on the middle roads. The average crown width by road size increased by 2.1m, and the difference in crown width appeared the most on the main road. The researchers analyzed that the fast-growth characteristics of American sycamore significantly affect the change amount in crown width. Street trees in the downtown area are planted 8m to 6m apart by adjusting the crown width to Daegu City's street tree management regulations. <Figure 4> shows a comparison bar graph of the change amount at crown width in 1997 and 2021 by road size.

Table 5. Analysis of the amount of change in crown width by road size.

(Unit: m)

Road size	Number of investigations	Crown width		Increase or decrease
		The 1997 year	The 2021 year	
Wide road	400	4.7	7.1	△2.4
Main road	400	4.1	7.7	△3.6
Middle road	100	7.7	8.4	△0.7
Average		5.6	7.7	△2.1

Figure 4. Comparison graph of the change amount at crown width in 1997 and 2021 by road size.

3.4. Analysis of the amount of change in diameter at breast height

<Table 6> shows the results of the analysis of the amount of change in diameter at breast height in 1997 and 2021 for wide, main, and middle roads. The trees grew in diameter at breast height by 8.4cm from 28.6cm to 37.0cm on the wide roads, by 10.8cm from 29.1cm to 40.0cm on the main roads, and by 19.2cm from 25.2cm to 44.4cm on the middle roads. The average diameter at breast height by road size increased by 12.8cm, and the difference in diameter appeared the most on the middle road. The researchers analyzed that the ginkgo trees on Pa-dong-ro in the middle road showed the most changes. <Figure 5> shows a comparison bar graph of the change amount in diameter at breast height in 1997 and 2021 by road size.
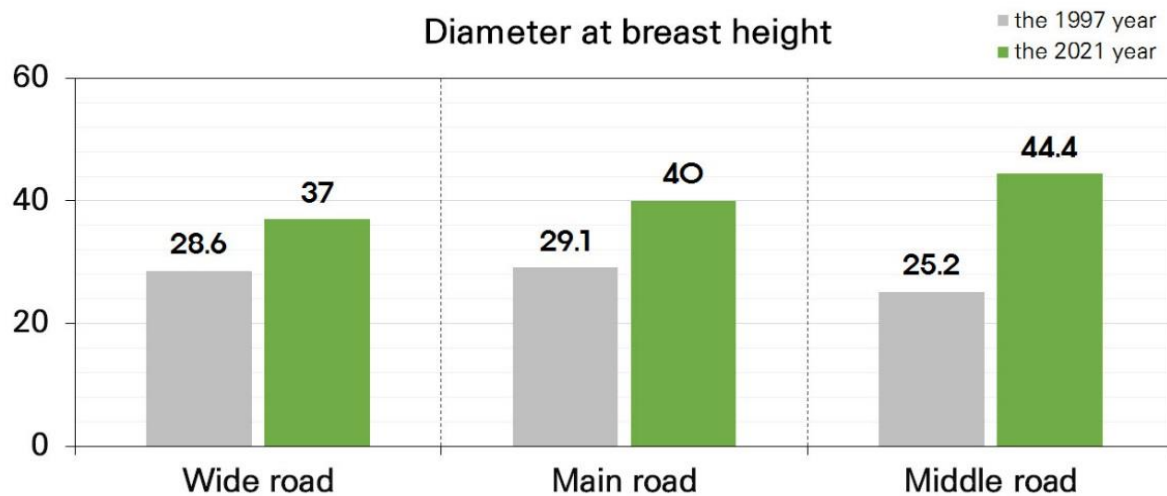
Table 6. Analysis of the change amount in diameter at breast height by road size.

(Unit: m)

Road size	Number of investigations	Diameter at breast height		Increase or decrease
		The 1997 year	The 2021 year	
Wide road	400	28.6	37.0	△8.4
Main road	400	29.1	40.0	△10.8
Middle road	100	25.2	44.4	△19.2
Average		27.7	40.4	△12.8

Figure 5. Comparison graph of the change amount in diameter at breast height in 1997 and 2021 by road size.

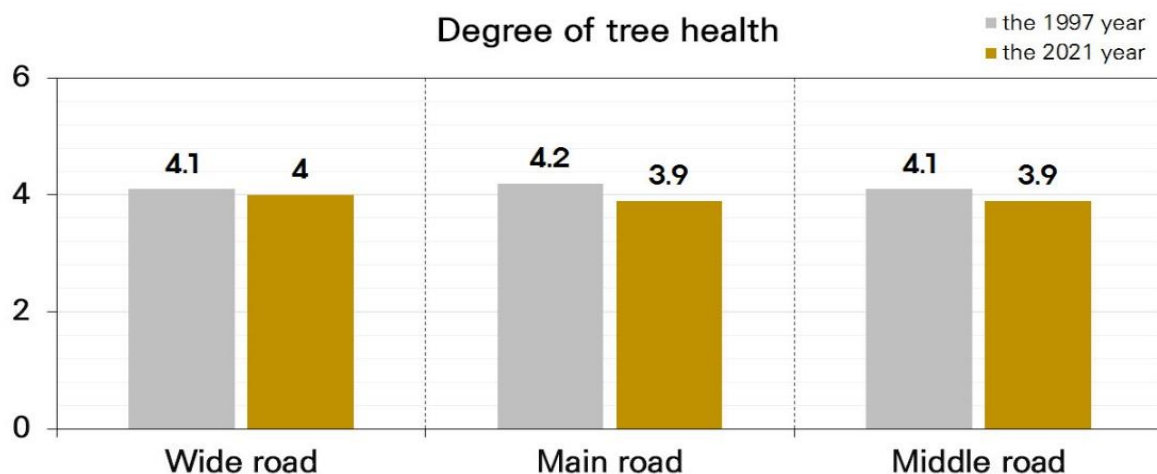## 3.5. Analysis of the amount of change in the degree of tree health

<Table 7> shows the results of the analysis of the amount of change in the degree of tree health in 1997 and 2021 for wide, main, and middle roads. The degree of tree health decreased by 0.1 points from 4.1 to 4.0 on the wide roads, by 0.3 points from 4.2 to 3.9 on the main roads, and by 0.2 points from 4.1 to 3.9 on the middle roads. The average degree of tree health by road size decreased by 0.2 points, and there was no significant difference by road size. <Figure 6> shows a comparison bar graph of the change amount in the degree of tree health in 1997 and 2021 by road size.

Table 7. Analysis of the change amount in the degree of tree health by road size.

(Unit: m)

Road size	Number of investigations	Degree of tree health		Increase or decrease
		the 1997 year	the 2021 year	
Wide road	400	4.1	4.0	▽0.1
Main road	400	4.2	3.9	▽0.3
Middle road	100	4.1	3.9	▽0.2
Average		4.1	3.9	▽0.2

Figure 6. Comparison graph of the change amount in the degree of tree health in 1997 and 2021 by road size.

3.6. Analysis of the amount of change in the degree of environmental damage
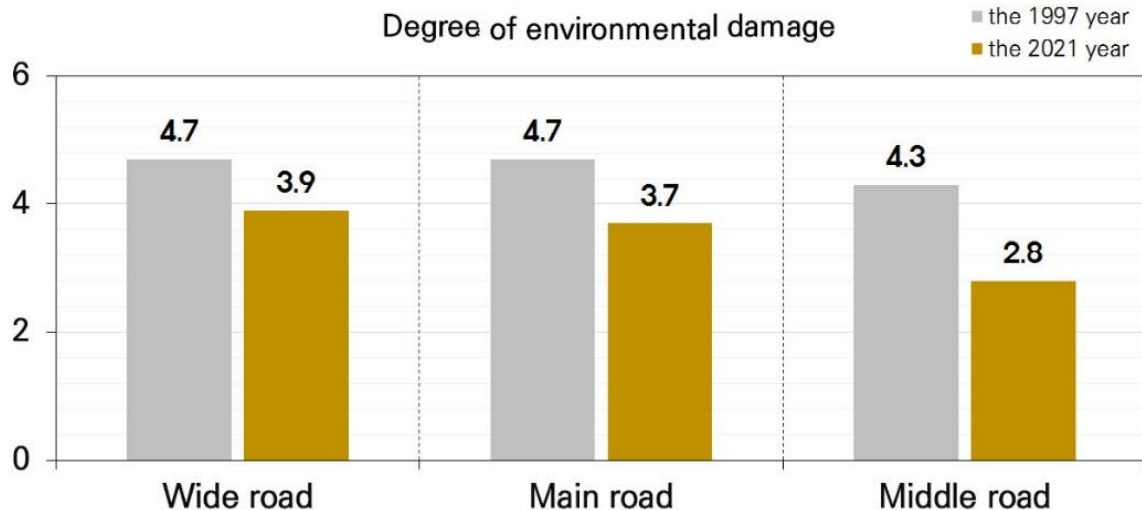
<Table 8> shows the results of the analysis of the amount of change in the degree of environmental damage in 1997 and 2021 for wide, main, and middle roads. The degree of environmental damage decreased by 0.8 points from 4.7 to 3.9 on the wide roads, by 0.9 points from 4.7 to 3.7 on the main roads, and by 1.5 points from 4.3 to 2.8 on the middle roads. The average degree of environmental damage by road size decreased by 1.1 points, and the degree of damage dropped the most on the middle road. The researchers analyzed that the degree of environmental damage decreased due to artificial management and interference. <Figure 7> shows a comparison bar graph of the change amount in the degree of environmental damage in 1997 and 2021 by road size.

Table 8. Analysis of the change amount in the degree of environmental damage by road size.

(Unit: m)

Road size	Number of investigations	Degree of environmental damage		Increase or decrease
		The 1997 year	The 2021 year	
Wide road	400	4.7	3.9	▽0.8
Main road	400	4.7	3.7	▽0.9
Middle road	100	4.3	2.8	▽1.5
Average		4.6	3.5	▽1.1

Figure 7. Comparison graph of the change amount in the degree of environmental damage in 1997 and 2021 by road size.

4. Conclusion

This study started with the idea that there might be problems in the growth state or artificial management in studying the growth and development condition of street trees in Suseong-gu, Daegu Metropolitan City. Naturally, street trees change over time, but the original form of trees and the appearance of street trees in ordinances differ.

The researchers conducted this study to provide necessary data for street tree management by analyzing the growth of street trees according to the road size in terms of temporal change and management. As a result of analyzing the current state of street trees in 2021 and the

change amount by road size in 1997 data, on average, the tree height increased by 5.4m, the root-collar diameter increased by 22.3cm, the crown width increased by 2.1m, and the diameter at breast height increased by 12.8cm. The degree of tree health decreased by 0.2 points, and the degree of environmental damage decreased by 1.1 points. The tree form of street trees did not have a natural tree shape due to artificial management, and street trees were damaged due to lack of management and damage from surrounding shops. There were scars on the branches and stems of roadside trees, and root uplift occurred due to the narrowness of the underground space. The uplifting of the sidewalk due to severe root uplift caused inconvenience to pedestrians, and the trees were leaning toward the roadside by cutting off the raised roots. The characteristic of the analysis results is that the appearance of street trees has grown, but street trees' growth aspects(tree health, environmental damage) have regressed due to incorrect pruning work with tall trees according to laws and ordinances. This paper suggests that street trees' species selection and improvement supplement work should be done through continuous research in the future, and systematic and efficient management should be continuously carried out for satisfaction with street trees and pedestrians.

5. References

5.1. Journal articles

[1] Lee HS & Kim SB. An Idea on the Status and Management Improvement of Street Tree in Dong-gu, Daegu City. *Journal of Recreation and Landscape*, 14(4), 71-79 (2020).

[2] Shin HY & Lee KE. Studies on the Characteristics and the Improvement Plan of Street Trees in Chuncheon City. *Journal of Forest Science*, 20, 144-169 (2004).

[3] Ryu Y. A Study on the Importance Analysis and Policy Direction of Street Tree Pruning in Daegu. *Journal of Daegu Gyeongbuk Development Institute*, 19(3), 67-82 (2020).

[4] Park EJ & Kang KY. Estimation of C Storage and Annual CO2 Uptake by Street Trees in Gyeonggi-do. *Korean Journal of Environment and Ecology*, 24(5), 591-600 (2010).

[5] Kim C & Lee H & Lim W. A Study on the Change in Plants of the Wind Power Complex in Mt. Hyeonjong. *Protection Convergence*, 5(2), 1-13 (2020). [Read More]

[6] Tak SC & Lee SY. A Study on Root Damage to Street Pavement from the Roots of Roadside Trees in Urban Areas: Focusing on Roadside Trees in Seo-gu, Daejeon City. *Journal of the Korean Institute of Landscape Architecture*, 46(3), 58-69 (2018).

[8] Hong J & Lee H & Cheon W & Lim W. An Investigation on the Differences of Management in Landscape Construction Projects. *Public Value*, 5(2), 32-38 (2020). [Read More]

[9] Lee KC & Park YJ. A Study on Improvement in the Environment for Planting and Growth of Street Trees. *Journal of Recreation and Landscape*, 7(1), 61-70 (2013).

[10] Lee CH. The Analysis on Retailer's Reaction on the Street Tree in Front of Store. *Journal of the Korea Forest Recreation Society*, 7(3), 9-16 (2003).

[11] Kim HW. The Present Conditions and Remedial Measures of Street Trees on Major Road of Gwang-ju Metropolitan City. *Journal of the Industrial Technology*, 14, 161-172 (2008).

[12] Lee J & Kwon G & Cheon W & Lim W. A Study on the Revitalization of Forest Management by Improving the Implementation Rate of Forest Projects. *International Journal of Human & Disaster*, 5(2), 1-9 (2020). [Read More]

[13] Sung HC & Min SH & Moon DM. Study on the Planting & Management of Roadside Tree in Kyonggi-do. *Kyonggi Research Institute*, 4, 3-14 (2002).

[14] Na YR & Lee DG & Kim TJ. Application of i-Tree Eco for Ecological Evaluation of Street Trees. *Journal of the Korean Society of Hazard Mitigation*, 22(2), 15-25 (2022).

[15] Park TK & Kim SK & Kim SH. A Study on Improvement of Growth Environment of Street Trees in Kimhae City. *Donga University Institute of Engineering and Construction Technology*, 24(1), 185-193 (2000).

[16] Jung SK & Park KH & Park JS & Kim HN. A Study on Coding Scheme for Street Trees Management Information System. *Journal of the Korean Association of Geographic Information Studies*, 3(1), 57-68 (2000).

[17] Lee CH & Park SH & Lim YM. Planting Structures and Landscape Types of Street Trees in Jangsu-gun. *The Journal of Korean Institute of Forest Recreation*, 16(2), 1-8 (2012).

[18] Kim YH & Ro Jl & Chu WJ & Gang HG & Kim MJ & Han JE & Park JS & Choi CS. A Survey on the Characteristics in Soil and Plants of Roadside in Incheon City. *Journal of Korea Society of Waste Management*, 23(6), 522-533 (2006).

[19] Park HS. The Management and Pruning of Street Trees. *Landscaping Tree*, 59(11), 22-24 (2000).

[20] Kim C & Lee H & Lim W. Improvement Plan Through Nonagreement Consultation Analysis of Small Scale Environmental Impact Assessment. *Public Value*, 6(1), 1-13 (2021). [Read More]

[21] Yang GC & Kim JG. The Role of Street Trees in Road Pollutants. *Korean Society of Road Engineers*, 9(2), 37-40 (2007).

[22] Lee NY & Ahn JS. Urban Landscape of Consumption Culture on Garosu-gil in Sinsa-dong, Seoul. *Journal of Photo Geography*, 22(3), 199-217 (2012).

[24] Kwon SS & Goo WS & Park CK. Studies on the Organism of Street Trees in Busan City. *Journal of Sokcang Academic Research of Traditional Culture*, 4, 75-84 (1980).

[25] Jo SM & Hyun CJ & Park SK. Analysis of the Influence of Street Trees on Human Thermal Sensation in Summer. *Journal of the Korean Institute of Landscape Architecture*, 45(5), 105-112 (2017).

[26] Lee HJ & Cheon WK & Lim WH. A Study of Prediction on the Species Number and Naturalization Index of Land Naturalized Plants. *International Journal of Human & Disaster*, 5(1), 10-23 (2020). [Read More]

[27] Na SS & Sung JW & Che SH & Kang SK. Satisfaction Analysis according to Planting Status of Roadside Trees in Gumi. *Journal of the Korea Forest Recreation Society*, 23(4), 53-62 (2019).

[28] Choi JY. A Study on the Situation and Improvement of Urban Street Trees in Kyongju. *The Journal of Kyongju Research*, 6, 143-160 (1997).

[29] Kwon GS & Cheon WK & Lim WH. A Study on the Actual Condition and Improvement Plan of Hierarchical Safety Management in Natural Parks. *International Journal of Crisis & Safety*, 5(1), 21-34 (2020). [Read More]

[30] Sung HC & Lee YJ & Min SH. A Study for the Present Status of Roadside Tree in Kyonggi-do. *Kyonggi Research Institute*, 16, 9-19 (2001).

[31] Woo SY & Lee DS & Lee SH. Research Air Pollution Effects on the Photosynthesis and Chlorophyll Contents of Street Trees in Seoul. *Korean Journal of Agricultural and Forest Meteorology*, 6(1), 24-29 (2004).

[32] Jeong JH & Lee KE. A Study of the Planting Characteristics of Street Trees and Herbaceous Plants in Gangwon-do. *Journal of the Korean Institute of Landscape Architecture*, 33(5), 57-68 (2005).

5.2. Thesis degree

[7] Ahn SH. A Study on the Characteristics of Pavement Uplift by Growth of Street Tree. University of Seoul, Master's Thesis (2014).

[23] Lee HJ. A Study on the Management Status of Street Trees and Improvement. Paichai University, Master's Thesis (2021).

6. Appendix

6.1. Author's contribution

	Initial name	Contribution
Lead Author	HU	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	CK	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	HL WL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Occupational Stress and Work Performance in Nurses

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Abstract

Purpose: This study is a descriptive survey to determine the impact of stress experienced by hospital nurses on their work performance.

Method: The research method was a survey of 122 nurses working in a more 300 bed hospital in J city in October 2022. As a research tool, the WPBE-TI, a 16-item measure of workplace stress developed by Lee(2014), was used, and the WPBE-CI, a 13-item measure of workplace stress outcomes, was used. Work performance was measured with the WPBE-CI, a 17-item instrument developed by Ko(2007) and others. The collected data were analyzed using the SPSS Window 24.0 program. The effect of occupational stress on job performance was analyzed using simple regression analysis.

Results: The results of this study showed that occupational stress has a significant effect on work performance, and the more occupational stress, the lower the work performance.

Conclusion: It is recommended to develop an awareness program to create an environment that reduces occupational stress.

Keywords: *Nurses, Stress, Occupation, Performance, Work*

1. Introduction

Occupation stress is a societal problem, and a study of 2,500 people over a five-year period found that 80.8% of people reported direct and indirect experiences of occupation stress, while 66.3% reported indirect experiences[1].

Hospitals are places where patients and their caregivers interact with hospital members such as doctors, nurses, and administrative staff who are responsible for medical care. Hospitals require high quality nursing care from nursing organizations in order to increase their competitiveness by providing high quality medical services and to protect the medical rights of patients and their guardians[2]. The nursing organization aims to provide nursing services strictly according to the standard of nursing care. Nurses' mistakes are not tolerated and accuracy is emphasized, which creates an environment that is prone to negative behaviors such as occupation bullying[3][4].

Occupation stress is intermittently reported in the media in Korea as occupation harassment, occupation bullying, or occupation bullying. A common word used to describe stress among nurses is "burnout" or "burnout". It is characterized by a persistent element of power imbalance that differs from simple conflict[5] and has a significant impact on the organization through physical discomfort such as headaches or indigestion, and mental symptoms such as depression, low self-esteem, anxiety, and suicide attempts, as well as absenteeism, sick leave, or tardiness. Stress among nurses is higher than other occupations in healthcare organizations and has been

25

identified as a strong predictor of nurse turnover and turnover intentions[6]. Therefore, occupation stress is no longer just an individual issue, but is critical for organizations to remain healthy and efficient[6][7]. Previous research suggests that nurses' occupation stress is not an individual issue, but is caused by a hierarchical or tolerant organizational culture. In addition, it often occurs covertly in the form of work-related violence rather than physical violence. These characteristics can blur the lines between victim and perpetrator, as victims as well as perpetrators may experience negative behaviors and not recognize them as harassment, or victims of harassment may step into the shoes of the perpetrator over time[8].

Nursing organizations increase nursing productivity and services at the level of individual nurses and nursing organizations, and produce nursing outcomes by operating organizational tasks efficiently[9][10].

Nursing performance refers to the extent to which nurses perform their duties rationally based on their expertise over a period of time to efficiently carry out the goals of the nursing organization. Measuring nurses' performance is to determine how effectively they perform their roles and responsibilities related to patient care[11]. Since treatment and care are the top priorities in the hospital setting, it is important to identify factors that affect occupation performance[12]. Therefore, this study aims to determine the effect of occupation stress on occupation performance by determining the extent to which nurses' occupation stress affects their occupation performance.

2. Purpose of Research

The purpose of this study is to determine the extent of occupation stress and occupation performance experienced by nurses and to determine the impact of stress on occupation performance. The research objectives are as follows.

1) Determine the level of stress in your audience's occupation.

2) Determine whether the subjects' occupation stress affects their nursing performance.

3) Determine the impact of the subject's occupation stress on their performance.

4) Identify the correlation between occupation stress and performance.

5) Identify factors that impact performance.

3. Literature Review

3.1. Occupation stress

Occupation stress is recognized as a problem that has a negative impact and hinders social development. In the early 1980s, a German doctor identified a pattern of school bullying in children and adolescents that was also seen in adults and coined the word mobbing. Later, in the 1990s, occupation stress was introduced on British public television and named bullying[13]. Researchers have used the term interchangeably, as it is difficult to distinguish occupation stress from mobbing, which is expressed as bullying between groups, horizontal violence, which occurs between coworkers, and harassment, which is often linked to sex[14][15]. Occupation stress is defined as persistent behaviors that are primarily negative and aggressive, causing humiliation, intimidation, fear, and self-blame[16]. Starting from a stress perspective, victims who are constantly exposed to primarily psychological harassment perceive the behavior as intentional or aggressive[17]. occupation stress is characterized by a power differential when compared to simple conflict[18]. Nurses in hospitals with authoritarian hierarchies are unable to

express and internalize stress arising from productivity or cost savings, patient contact, or relationships with other organizations. Nurses who experience constant frustration of their needs are described as bullying their more powerless coworkers out of anger and helplessness[18]. Research on occupation stress among nurses has focused on the reality of stress and its negative effects. When stress is accepted as a normal process in an organization, it can adversely affect individuals' physical and psychological health, interfere with positive occupation performance, and lead to turnover and retirement[19][20][21]. Organizational factors have a greater impact on occupation stress than personal characteristics, including demographics[22]. Nurses have a negative perception that there is something wrong with them, resulting in less than 10% formal reporting or proactive coping, and low levels of satisfaction[23]. For this reason, victimization is often self-reported or concealed, resulting in low work motivation and poor work performance[21].

3.2. Performance

Occupation performance is the degree to which the organization's objectives are accomplished efficiently by rationally performing the role based on expertise in the occupation, and it refers to the actual execution of tasks related to the activities required by the target patient[24][25]. According to Northcott(1977), nursing performance is an evaluation of how well nurses have performed their duties over a period of time and has been treated as an important strategy to ensure productivity and quality nursing care in hospitals[26]. Nursing performance indicates the extent to which nursing functions are performed, and the measurement of nursing performance takes into account the quantity and quality of nursing tasks, as well as the utilization of time and resources[24]. Nursing practice is divided into independent nursing activities, non-independent nursing activities and interpersonal activities. Independent nursing activities are the process of providing nursing care to nursing clients individually as a professional nurse, i.e., directly performing nursing assessment, nursing planning, implementation, and evaluation, as well as a series of nursing management processes to ensure that the nursing team jointly achieves nursing goals[27]. Non-autonomous nursing activities are those performed by nurses that are not unique to professional nurses but are considered to be traditional nursing activities, such as collaborating with physicians and performing administrative delegated tasks[27]. Interpersonal activities are those that involve frequent communication with coworkers, staff from other departments, and caregivers in the performance of nursing duties.

4. Research Method

4.1. Research design

The purpose of this study is a descriptive survey to identify occupation stress and its impact on occupation performance among nurses working in a more 300 bed hospital in J city.

4.2. Research tool

4.2.1. Occupation stress

Occupation bullying occurs within an unstable dynamic of vulnerability between individuals and groups or between individuals and groups within an organizational culture and power imbalance. It manifests itself in the form of persistent verbal and non-verbal harassment, work-related harassment, and extrinsic threats, and causes physical and psychological atrophy in individuals as well as increased negative energy in the organization. occupation stress was measured with the occupation bullying type tool and occupation bullying outcome tool developed by Lee[4].

4.2.1.1. Type of occupation harassment

The occupation Bullying Experience in Nursing - Type Inventory(WPBE-TI) is a 16-item instrument consisting of three sub-scales: verbal and nonverbal bullying, work-related bullying, and extrinsic threats. It is measured on a 4-point Likert scale with 4 for "very much so," 3 for "somewhat so," 2 for "somewhat not so," and 1 for "not at all so," with higher scores indicating greater exposure to occupation bullying. At the time of development, the instrument had a Cronbach's α of .91, with subscale Cronbach's α ranging from .64 to .91, and in this study, the instrument had a Cronbach's α of .88, with subscale Cronbach's α ranging from .62 to .87.

4.2.1.2. Consequences of occupation harassment

The occupation Bullying Experience in Nursing - Consequence Inventory(WPBE-CI) is a 13-item tool with three subscales: physical and psychological atrophy, decreased quality of care, and increased distrust. It is measured on a 4-point Likert scale with 4 for "very much so," 3 for "somewhat so," 2 for "somewhat not so," and 1 for "not at all so," with higher scores indicating a greater impact of occupation bullying, ranging from a low of 13 to a high of 52. At the time of development, the instrument had a Cronbach's α of .90, with Cronbach's α for each subscale ranging from .67 to .88, and the Cronbach's α for this study was .87, with Cronbach's α for each subscale ranging from .42 to .84.

4.2.2. Performance

The occupation performance measurement tool was developed by Ko et al.[28]. The instrument consists of 17 items and four subdomains: occupation performance ability, occupation performance attitude, work level improvement, and application of nursing process. It was measured on a 4-point Likert scale with 4 for "very much so," 3 for "somewhat so," 2 for "somewhat not so," and 1 for "not at all so," with a minimum score of 17 and a maximum score of 68, with higher scores indicating higher nursing performance. At the time of development, the Cronbach's α of the tool was .92, and the Cronbach's α of each subscale was .68~.88, and the Cronbach's α of this study was .94, and the Cronbach's α of each subscale was .77~.88.

5. Data Collection Method and Ethical Tool

The nursing department was informed of the purpose and methods of the study and their cooperation was sought for data collection. Participants were informed of their rights, confidentiality, and the purpose of the study. Participants were informed that they could withdraw from the study at any time during the questionnaire. Explained that the data collected will be kept confidential and used for research purposes only. Written consent was obtained to participate in the study on a voluntary basis. The questionnaire took about 10-15 minutes to complete. After completing the questionnaire, we offered a small gift.

6. Data Analysis Method

The data collected in this study were analyzed using the SPSS 24.0 program as follows.

1) The general characteristics of the subjects, types of occupation stress, occupation stress consequences, and work performance were analyzed using frequency analysis.

2) The types of occupation stress, occupation stress outcomes, and work performance according to the general characteristics of the subjects were analyzed using t-tests.

3) The correlation between the types of occupation stress, occupation stress outcomes, and work performance of the subjects was analyzed using Pearson`s correlation.

4) The impact of the subjects' occupation stress on their work performance was analyzed by simple regression analysis.

7. Results

7.1. General characteristics

The general characteristics of the subjects are shown in <Table 1>. Gender was 78(63.9%) female and 44(36.1%) male, age was 60(49.2%) under 30 and 62(50.8%) over 30. Marital status was 60(49.2%) single and 62(50.8%) married. Position was 82(67.2%) general nurses and 40(32.8%) charge nurses, and education was 36(29.5%) diploma and 86(70.5%) bachelor's degree. 64(52.5%) worked shifts and 58(47.5%) worked full-time. 70(57.4%) worked in wards and 52(42.6%) in specialty departments. Total clinical experience was 64(52.5%) for less than 5 years and 58(47.5%) for more than 5 years. Current departmental experience was 62(50.8%) for less than 3 years and 60(49.2%) for more than 3 years <Table 1>.

Table 1. General characteristics.

Variables	Categories	n(%)
Gender	Female Male	207(94.1) 13(5.9)
Age (years)	<30 ≥30	60(49.1) 62(50.8)
Marital status	Unmarried Married	60(49.2) 62(50.8)
Position	Nurse practitioner Charge nurse	82(67.2) 40(32.8)
Education	Bachelor of science Bachelor's	36(29.5) 86(70.5)
Shift types	Shifts Full-time	64(52.5) 58(47.5)
Department	Wards Specialized departments	70(57.4) 52(42.6)
Total clinical experience (years)	<5 ≥5	64(52.5) 58(47.5)
Experience in your current department (years)	<3 ≥3	62(50.8) 60(49.2)

Note: N=120.

7.2. Type and consequences of occupation bulling and nursing performance

In this study, the relationship between occupation bullying and nursing performance is shown in <Table 2>. The mean score for the type of occupation harassment was 1.55±0.44, and the sub-scale scores were 1.58±0.53 for verbal and non-verbal harassment, 1.64±0.54 for work-related harassment, and 1.16±0.54 for extrinsic threats. The mean score for the occupation bullying outcome was 1.8±0.53, and the mean score for each subscale was 2.17±0.64 for physical and psychological atrophy, followed by 1.73±0.68 for decreased quality of care, and 2.08±0.67 for increased distrust. The mean score of the subjects' nursing performance was 3.11±0.49, and the sub-scale scores were 3.06±0.48 for nursing performance ability, 3.01±0.55 for nursing performance attitude, 3.12±0.63 for nursing performance level improvement, and 3.32±0.54 for nursing process application.

Table 2. Types and consequences of occupation bullying and nursing performance.

Variables	Categories	n(%)
Types of occupation harassment	16	1.55±0.44
Verbal and nonverbal harassment	10	1.58±0.53
Work-related harassment	4	1.64±0.54
External threats	2	1.16±0.54
Occupation harassment consequences	13	1.8±0.53
Physical and psychological atrophy	9	2.17±0.64
Poor quality of care	2	1.73±0.68
Increased distrust	2	2.08±0.67
Nursing Performance	17	3.11±0.49
Nursing competency	7	3.06±0.48
Attitudes toward nursing practice	4	3.01±0.55
Improving the quality of nursing care	3	3.12±0.63
Nursing curriculum application	3	3.32±0.54

Note: N=120.

7.3. Difference type of occupation harassment on common characteristics

<Table 3> shows the results of analyzing the differences in the types of occupation bullying according to general characteristics. There were significant differences in age(t=3.43, p<.001), marital status(t=-3.67, p=<.001), and education(t=-3.32, p=.001).

Table 3. Difference in types of occupation bullying based on common characteristics.

Variables	Categories	N	Types of occupation harassment		
			M±SD	t	P
Gender	Female Male	78 44	1.57±.44 1.38±.48	1.39	.171
Age (three)	< 30 ≥30	60 62	1.70±.47 1.39±.38	3.43	<.001***
Marital status	Unmarried Married	60 62	1.64±.48 1.34±.31	-3.67	<.001***
Position	Nurse practitioner Charge nurse	82 40	1.57±.47 1.44±.38	1.63	.309
Education	Bachelor science Bachelor's	36 86	1.38±.40 1.68±.45	-3.32	.001**
Shift types	Shifts Full-time	64 58	1.52±.40 1.59±.56	-.62	.552
Department	Wards Specialized departments	70 52	1.50±.48 1.63±.37	-1.25	.217
Total clinical experience (years)	< 5 ≥5	64 58	1.63±.37 1.47±.50	1.69	.095
Years of experience in your current role(years)	< 3 ≥3	62 60	1.51±.470 1.58±.42	-.61	.545

Note: N=120, *p<.05, **p<.01, ***p<.001.

7.4. Difference in occupation bullying outcomes base on common characteristics

The results of the analysis of differences in occupation bullying outcomes by demographic characteristics are shown in <Table 4>. There were significant differences in gender(t=2.14, p=.035) age(t=2.05, p=.044), marital status(t=-2.94, p=.004), and years of experience in the current department(t=-2.27, p=.026).

Table 4. Difference in types of occupation bullying based on common characteristics.

Variables	Categories	N	Types of occupation bullying outcomes		
			M±SD	t	P
Gender	Female Male	78 44	1.99±.51 1.64±.67	2.14	.035**
Age (three)	< 30 ≥30	60 62	2.05±.56 1.83±.49	2.05	.044*
Marital status	Unmarried Married	60 62	2.04±.60 1.73±.33	2.94	.004**
Position	Nurse practitioner Charge nurse	82 40	1.94±.54 1.93±.56	.056	.956
Education	Bachelor of science Bachelor's	36 86	1.92±.43 1.95±.62	-.39	.694
Shift types	Shifts Full-time	64 58	1.92±.58 1.96±.43	-.39	.767
Department	Wards Specialized departments	70 52	1.91±.56 2.00±.50	-.87	.389
Total clinical experience (years)	< 5 ≥5	64 58	1.98±.60 1.92±.48	.51	.612
Years of experience in your current role(years)	< 3 ≥3	62 60	1.84±.55 2.09±.49	-2.27	.026*

Note: N=120, *p<.05, **p<.01, ***p<.001.

7.5. Difference in nursing performance base on common characteristics

The results of analyzing nursing work performance according to general characteristics are as follows <Table 5>. There were significant differences in age(t=-4.51, p<.001), marital status(t=3.06, p=.003), position(t=-2.85, p=.005), type of work(t=-2.21, p=.029), department(t=-2.36, p=.020), total clinical experience(t=-5.77, p<.001), and current department experience(t=-2.89, p=.005).

Table 5. Difference in nursing performance base on common.

Variables	Categories	N	Nursing performance		
			M±SD	t	P
Gender	Female Male	78 44	3.10±.47 3.08±.53	.11	.919
Age (three)	< 30 ≥30	60 62	2.88±.41 3.28±.45	-4.51	<.001***
Marital status	Unmarried Married	60 62	2.98±.43 3.31±.50	3.06	.003**

Position	Nurse practitioner Charge nurse	82 40	3.02±.47 3.37±.40	-2.85	.005**
Education	Bachelor of science Bachelor's	36 86	3.19±.48 3.01±.47	1.54	.130
Shift types	Shifts Full-time	64 58	3.02±.45 3.26±.50	-2.21	.029*
Department	Wards Specialized departments	70 52	3.02±.44 3.27±.49	-2.36	.020*
Total clinical experience (years)	< 5 ≥5	64 58	2.85±.40 3.33±.41	-5.77	<.001***
Years of experience in your current role(years)	< 3 ≥3	62 60	2.96±.45 3.24±.47	-2.89	-.005**

Note: N=120, *p<.05, **p<.01, ***p<.001.

7.6. Correlations between type of occupation bullying outcomes, and nursing performance

The results of the correlations between occupation bullying types, occupation bullying outcomes, and nursing performance are shown in <Table 6>. The type of occupation bullying was significantly positively correlated with occupation bullying outcomes(r=.32, p=.003) and negatively correlated with nursing performance(r=-.22, p=.041).Verbal and nonverbal bullying, a subdomain of occupation bullying, was significantly positively correlated with occupation bullying outcomes(r=.27, P=.001) and negatively correlated with nursing occupation performance(r=-.32, p=.004). Work-related bullying, a subset of occupation bullying, was significantly positively correlated with occupation bullying outcomes(r=.41, p<.001) and negatively correlated with nursing occupation performance(r=-.32, p=.004).Decreased quality of care, a subscale of occupation bullying outcomes, was significantly and negatively associated with nursing occupation performance(r=-.26, p=.023).

Table 6. Type of occupation bullying, occupation bullying outcomes, and correlations with nursing performance.

Variables	Value	Occupation harassment consequences	Performance
Types of occupation harassment	r P	.32 .003*	-.22 .041*
Verbal and nonverbal harassment	r P	.27 .001*	-.32 .004*
Work-related harassment	r P	.41 <.001**	-.32 .004**
External threats	r P	-.03 .812	-.17 .357
Occupation harassment consequences	r P	1	-.19 .075
Physical and Psychological atrophy	r P	1	-.20 .065
Poor quality of care	r P	1	-.26 .023*
Increased distrust	r P	1	-.03 .766

Note: N=120, *p<.05, **p<.01, ***p<.001.

7.7. The impact of occupation bullying experience nursing performance

A simple regression analysis was conducted to examine the effect of occupation bullying on nursing performance. Before conducting the regression analysis, the dependent variable was checked for autocorrelation using the Durbin-Watson index, and the result was 1.987, indicating that it was independent without autocorrelation, so the data were suitable for regression analysis. To examine the appropriateness of the regression model for nursing work performance, the model fit test was conducted using the normality and equidispersity tests of the residuals, and the residuals met the assumptions of normality(Kolmogorov-Smirnov`s p=.998>.05) and equidispersity(Breusch-Pagan`s p=.887>.05), indicating that the regression model is appropriate. The regression analysis of the effect of occupation bullying on nursing performance showed that occupation bullying had a significant effect on nursing performance(p=.001). The higher the occupation bullying, the lower the nursing performance, and the explanatory power of occupation bullying on nursing performance is 10% <Table 7>.

Table 7. Impact of occupation bullying on nursing performance.

	R^2	Changed R^2	β	F	p
Occupation harassment	.100	.090	.316	9.727	.001**

Note: N=120, *p<.05, **p<.01, ***p<.001.

8. Discussion

This study was conducted to determine the impact of nurses' experiences of occupation bullying on their nursing performance. In this study, the mean score of occupation bullying types was 1.55±0.44 out of 4, and the subcategories were work-related bullying, verbal and non-verbal bullying, and extrinsic threats, indicating that the level of work-related bullying was higher than extrinsic threats. There were significant differences in the types of occupation harassment by age, marital status, and education. Those under the age of 30 and single were more likely to be harassed by those with a bachelor's degree or higher, which is similar to previous studies[1][29]. In addition, the outcome of occupation bullying for the subjects was an average of 1.8±0.53 out of 4, and the scores for each sub-domain were the highest for physical and psychological atrophy with an average of 2.17±0.64, followed by decreased quality of care with an average of 1.73±0.68, and increased distrust with an average of 2.08±0.67. The differences in the types of occupation bullying were significantly related to age, marital status, and education. This suggests that occupation bullying is a frequent phenomenon that occurs regardless of age or experience, as nurses were significantly associated with occupation bullying despite being older and more experienced. In this study, the mean score of nursing occupation performance was 3.11±0.49 out of 4, and the sub-scale scores were 3.06±0.48 for nursing occupation performance ability, 3.01±0.55 for nursing occupation performance attitude, 3.12±0.63 for nursing occupation quality improvement, and 3.32±0.54 for nursing process application. There were significant differences in nursing occupation performance(age, marital status, position, work type, work department, total clinical experience, and current work department experience). This means that nurses have a lot of clinical experience, and I think it is because the more clinical experience they have, the more stable they are physically and psychologically, and the more they can focus on nursing work. However, when nurses experience occupation bullying, they feel helpless and make errors in their nursing work and nursing performance, which leads to distrust among nurses and decreases the quality of nursing care. In order to solve this problem, it is necessary to organize communication and education among nurses, and it is not an emergency measure, but a continuous attention and systematic method. This study examined the

relationship between occupation bullying types, occupation bullying outcomes, and nursing performance and found a significant positive relationship between occupation bullying types and occupation bullying outcomes and a significant negative relationship between occupation bullying types and nursing performance. There was a significant positive correlation between verbal and non-verbal bullying, a subset of occupation bullying, and occupation bullying outcomes, and a significant negative correlation between verbal and non-verbal bullying and nursing performance. Work-related bullying, a subset of occupation bullying types, was significantly positively associated with occupation bullying outcomes, and occupation bullying outcomes were significantly negatively associated with nursing performance. Poor quality of care, a subdomain of occupation bullying outcomes, was significantly and negatively associated with nursing occupation performance. Of note, the subdomains of occupation bullying, verbal and nonverbal bullying and work-related bullying, were positively associated with occupation bullying outcomes and significantly inversely associated with nursing performance. For verbal and non-verbal bullying, interventions should include organic and active communication among coworkers through programs to build rapport and cooperation among nurses[30], and active intervention through periodic interviews and surveys of nursing managers such as head nurses and nursing directors. Work-related bullying should be addressed at the most fundamental level, given that Korea currently has a low number of nurses per patient according to the OECD. In order to reduce the number of nurses who leave or retire, programs for nurse communication and the establishment of a system to prevent the occurrence and recurrence of bullying among nurses should be implemented. Regression analysis of the effect of occupation bullying on nursing performance shows that occupation bullying has a significant effect on nursing performance(p=.002). The higher the level of occupation bullying, the lower the nursing performance, and the explanatory power of occupation bullying on nursing performance is 10%. It should be recognized that the presence of occupation bullying among nurses is not only a problem for their mental and physical health, but also for their nursing performance, i.e., the quality of healthcare services provided to patients. In recent years, the government has increased the number of nursing students in order to solve the nursing shortage, but occupation harassment of nurses in clinical practice has not been resolved to date. Recognized as a social problem, occupation harassment of nurses requires a fundamental solution instead of short-term policies and plans.

9. Conclusion

This study was conducted to determine the extent of occupation bullying among nurses, their nursing performance, the relationship between them, and the negative impact of occupation bullying on nursing performance. In terms of types of occupation harassment, work-related harassment was the most common, followed by verbal and non-verbal harassment and extrinsic threats. When analyzing differences in occupation harassment types, harassment outcomes, and nursing performance by general characteristics, age, marital status, and education were significant for harassment types, and gender, age, marital status, and years of experience in the occupation were significant for harassment outcomes. For nursing occupation performance, there were significant differences in age, marital status, position, work type, department, clinical experience, and experience in the current department. The results of the correlations between occupation bullying type, occupation bullying outcomes, and nursing performance showed that occupation bullying outcomes were significantly and positively correlated with occupation bullying type; verbal and nonverbal bullying, a subset of occupation bullying type, were significantly and positively correlated with occupation bullying outcomes; extrinsic threat was significantly and negatively correlated with occupation bullying outcomes; and nursing performance was significantly and negatively correlated with occupation bullying outcomes. Work-related bullying, a subset of occupation bullying types, was significantly positively associated

with occupation bullying outcomes and negatively associated with nursing occupation performance. The regression analysis of the effect of occupation bullying on nursing performance showed that occupation bullying had a significant effect on nursing performance, and the higher the occupation bullying, the lower the nursing performance. Therefore, if there is a problem in the nursing field, it is necessary to focus on fact-based problematic behavior without violating the privacy of nurses, and to communicate so that it does not lead to verbal violence. In this regard, it is urgently necessary for the nursing department and the medical department to work together to prevent and take measures against verbal abuse at the hospital level.

10. Suggestion

Suggestions for follow-up studies are as follows. First, this study is limited to one hospital in a specific region, and we suggest replication studies with nurses working in different regions and in different hospitals to draw generalized results. Second, we recommend developing programs to improve the organizational culture of nurses and create an enjoyable occupation to prevent bullying and burnout. Third, we recommend that systemic issues such as working conditions be addressed to improve nurses' health.

11. References

11.1. Journal articles

[4] Hutchinson M & Wilkes L & Jackson D & Vickers MH. Integrating Individual, Work Group and Organizational Factors: Testing a Multidimensional Model of Bullying in the Nursing Workplace. *Journal of Nursing Management*, 18(2), 173-181 (2010).

[5] Lee YJ & Lee EJ. Conceptual Development of Workplace Bullying: Focusing on Hospital Nurses. *Korea Journal of Health Education and Promotion*, 31(1), 57-70 (2016).

[7] Dumont C & Meisinger S & Whitacre MJ & Corbin G. Nursing 2012 Horizontal Violence Survey Report. *Nursing*, 42(1), 44-49 (2012).

[8] Kang JY & Yun SY. A Grounded Theory Approach on Nurses' Experience with Workplace Bullying. *Journal of Korean Academy of Nursing*, 46(2), 226-237 (2016).

[10] Kim Y. Learning Attitude to an Convergence Evaluation Method for Fundamental Nursing Practice Education, Self-leadership and Academic Self-efficacy in Nursing Students. *Protection Convergence*, 5(2), 70-83 (2020). [Read More]

[11] Son YJ & Lee YA & Sim KN & Kong SS & Park YS. Influence of Communication Competence and Burnout on Nursing Performance of Intensive Care Units Nurses. *Journal of Korean Academy Fundamental of Nursing*, 20(3), 278-288 (2013).

[14] Vessey JA & Demarco R & Difazio R. Bullying Harassment and Horizontal Violence in the Nursing Workplace the State of the Science. *Annual Review of Nursing Research*, 28(1), 133-157 (2010).

[15] Paula S & Amy Huynh & Jane GD. Defining Workplace Bullying Behavior Professional Lay Definitions of Work Place Bullying. *International Journal of Law and Psychiatry*, 30(4-5), 340-354 (2007).

[16] Leymann H. The Content and Development of Mobbing at Work. *European Journal of Work and Organizational Psychology*, 5(2), 165-184 (2008).

[17] Gillen P & Sinclair M & Kernohan G. A Concept Analysis of Bullying in Midwifery. *Evidence Based Midwifery*, 2(2), 46-51 (2004).

[19] Johnson SL & Rea RE. Workplace Bullying Concerns for Nurse Leaders. *The Journal of Nursing Administration*, 39(2), 84-90 (2009).

[22] Hutchinson M & Jackson D & Wilkes L & Vickers M. A New Model of Bullying in the Nursing Workplace: Organizational Characteristics as Critical Antecedents. *Advances in Nursing Science*, 31(2), 60-71 (2008).

[23] McKenna BG & Smith NA & Poole SJ & John H. Horizontal Violence: Experience of Registered Nurses in Their First Year of Practice. *Journal of Advanced Nursing*, 42(1), 90-96 (2003).

[26] Northcott AM. Reflection on Performance. *Nursing Times*, 93(26), 49-52 (1997).

[28] Ko YK & Lee TW & Lim JY. Development of Performance Measurement Scale for Hospital Nurses. *Journal of Korean Academy of Nursing*, 37(3), 286-294 (2007).

11.2. Thesis degree

[2] Kim YO. The Influence of Verbal Abuse on Job Stress and Turnover Intention of Nurse: The Special Department and General Ward. Gachon University, Master's Thesis (2017).

[3] Lee EM. Impact of Bullying in the Workplace on Nursing Service Quality: Moderating Effect of Professional Self Concept. Woosuk University, Master's Thesis (2017).

[6] Lee YJ. The Conceptual Development and Development of New Instruments to Measure Bullying in Nursing Workplace. Inha University, Doctoral Thesis (2014).

[9] Park YS. Influence of Bullying in the Workplace, Burnout and Health Status on Nursing Performance in the Small and Medium-sized Public Hospital. Catholic Kwandong University, Master's Thesis (2017).

[12] Im MY. Effects of Empowerment, Communication Ability, and Job Stress on Nursing Service Performance of Small and Medium-sized Hospital Nurses. Kongju National University, Master's Thesis (2016).

[21] Nam W. The Relationship between Workplace Bullying and Intention to Leave among Nurses in One University Hospital. Catholic University, Master's Thesis (2010).

[24] Yoon EJ. A Study on the Effects of Organizational Characteristics on Work Performance Efficiency: Focusing on Hospital Organizations. Daegu National University, Doctoral Thesis (1995).

[25] Jeong YJ. The Relationship between Professional Self-concept and Nursing Performance of Hospital Nurses. Keimyung University, Master's Thesis (1998).

[29] Park SY. The Relationships among Workplace Bullying, Job Stress, and Turnover Intention in Nurses Working at Hospital. Hanyang University, Master's Thesis (2016).

[30] Choi EJ. The Effect of Job Stress and Coping Type on Nursing Performance among a University Hospital Nurses. Inje University, Master's Thesis (2010).

11.3. Books

[1] Kim GJ & Lee KH. The Prevalence of Workplace Bullying and Institutional Discipline. Korea Labor Institute (2017).

[13] Pamela LS & Beverly DB. Destructive Organizational Communication: Process, Consequence, and Constructive Ways of Organizing. Routledge (2009).

[27] Korn T. The Management of Patient Care, Philadelphia. WB. Saunders (1981).

11.4. Additional references

[18] http://www.cdc.gov/ (2018).
[20] http://www.cinahl.com/ (2023).

12. Appendix

12.1. Authors contribution

	Initial name	Contribution
Lead Author	SH	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑
Corresponding Author*	ML	-Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Effect of ADHD Tendency on Depression and Anxiety in Elementary School Students: Mediating Effects of Friend Support

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Abstract

Purpose: The aim of this study was to examine the influences of elementary school students' ADHD tendency on their emotional problems such as depression and anxiety, and to verify the mediating effects of social relationships, specifically friend support, on these influences.

Method: This study involved 456 students from two elementary schools in the capital area. The participants were surveyed regarding their ADHD tendency, friend support, depression, and anxiety levels. The data gathered were subsequently analyzed using a Structural Equation Model.

Results: The results of the study are as follows: first, it was discovered that ADHD tendency in elementary school students directly affect friend support negatively. Second, the ADHD tendency was found to increase their levels of depression and anxiety, either directly or indirectly. Third, the ADHD tendency was shown to augment depression and anxiety via the route of friend support. Specifically, it was found that the paths of 'ADHD tendency → friend support → depression', 'ADHD tendency → depression → anxiety', 'ADHD tendency → friend support → depression → anxiety' were statistically significant.

Conclusion: The findings of this study can serve as basic data for developing effective emotional intervention programs for students with ADHD tendency, by identifying the specific paths through which these students' ADHD tendency influence their emotional difficulties.

Keywords: ADHD, ADHD Tendency, Friend Support, Depression, Anxiety

1. Introduction

Attention-Deficit/Hyperactivity Disorder(ADHD) is a neurodevelopmental disorder that has recently attracted significant attention within school settings. Key symptoms of ADHD include attention deficit, hyperactivity, and impulsivity[1]. Specifically, children with ADHD often fail to pay close attention to details, making careless mistakes in their studies, careers, or other activities[2]. They may struggle with maintaining continuous attention during work or play and often avoid, dislike, or resist tasks that require sustained mental effort[3]. These symptoms of ADHD, which present before the age of 12, can cause various difficulties for children both at home and in school[4].

In recent years, the number of children diagnosed with ADHD has been increasing rapidly. According to a 2021 study by Bitsko et al., approximately 9.8% of children and adolescents aged 3-17 in the United States had been diagnosed with ADHD as of 2019[5]. In Korea, the number of students being diagnosed with ADHD is also on a rapid rise. According to the National Health Insurance Service in Korea, the number of teenagers diagnosed with ADHD rose by approximately 40%, increasing from 30,000 in 2017 to 42,000 in 2021[6]. In 2021, statistics indicated that approximately 600 out of every 100,000 teenagers(about 0.6%) were diagnosed with ADHD.

However, the average worldwide prevalence of ADHD in children is between 5% to 7%[7]. Based on these statistics, it's evident that in Korea, still over 90% of adolescents with ADHD remain undiagnosed.

One of the primary reasons for focusing on children with ADHD in school settings is their tendency to exhibit serious emotional problems. Prior studies have consistently shown that children with ADHD are more likely to exhibit symptoms of depression and anxiety compared to their peers[8][9][10]. These emotional challenges can lead to various physical issues such as insomnia and indigestion, diminish their motivation to learn, and result in poor academic performance[11][12]. Moreover, to cope with their struggles, children with ADHD may turn to gaming or drug addiction[13]. If symptoms of depression and anxiety become severe, the likelihood of them making extreme choices, such as suicide, increases[9].

Given these issues, it is crucial to have treatments that can alleviate the symptoms in children with ADHD. The most common treatment is medication[14]. In Korea, it is reported that more than 90% of elementary, middle, and high school students diagnosed with ADHD are on medication[15]. Currently, treatments primarily used for ADHD in Korea include the central nerve stimulant such as Methylphenidate, Atomoxetine, and the sympathetic nerve stimulant Clonidine[16]. These medications help to reduce attention deficit and hyperactivity symptoms in children with ADHD, enabling them to better adapt to life at home and school.

However, while medication can effectively mitigate primary ADHD symptoms, its long-term impact on emotional problems such as depression and anxiety remains unclear. In particular, some children with ADHD experience various side effects from medication[17]. Side effects of ADHD medication can include anxiety, excitement, insomnia, headaches, and discomfort. Due to these side effects and the limitations of medication, there is an ongoing argument for alternative interventions to address the emotional challenges faced by children with ADHD.

In order to develop an emotional intervention program for children with ADHD, it is vital to first accurately identify the process through which ADHD tendency lead to emotional issues such as depression and anxiety. Previous studies have suggested that difficulties in forming social relationships, often seen in children with ADHD, are closely related to their emotional problems. Several earlier studies consistently show that children with ADHD struggle to form proper relationships with others and frequently experience negative emotions in interpersonal situations[18][19]. Children with ADHD often encounter conflicts and negative interactions in their relationships with parents, teachers, and peers. Moreover, previous research has indicated that these interpersonal difficulties can diminish a child with ADHD's self-esteem, leading to further emotional difficulties[20].

Understanding how ADHD tendency lead to difficulties in social relationships and emotional problems, and further identifying the structural relationship between ADHD tendency, social relationships, and emotional problems, can offer significant insights when developing an intervention program to address emotional problems in children with ADHD. Therefore, this study aims to explore how ADHD tendency in elementary school students influence emotional problems including depression and anxiety in the context of social relationship such as friend support. The study will also seek to identify the structural relationship between ADHD tendency, friend support, depression, and anxiety in these students. The specific research questions are as follows:

First, how do ADHD tendency in elementary school students influence friend support?
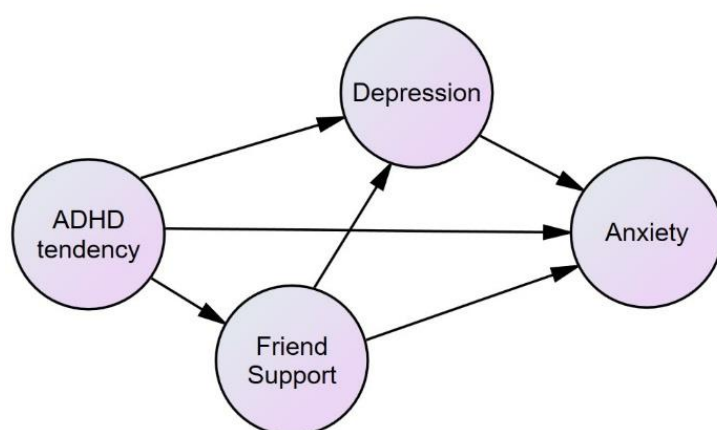Second, how do ADHD tendency in elementary school students influence depression and anxiety?
Third, how do ADHD tendency in elementary school students influence depression and anxiety through the mediation of friend support?

2. Research Method

2.1. Hypothetical model

The research model is designed to examine the direct and indirect impacts of ADHD tendency on emotional problems such as depression and anxiety. ADHD tendency are hypothesized to directly exacerbate these emotional problems, while also indirectly increasing them through lowering friend support. Friend support is hypothesized to mediate the relationship between ADHD tendency and the emotional problems. The specific research model is as presented in <Figure 1>.

Figure 1. Hypothetical model.

2.2. Research subject

In this study, data were collected from 456 students in grades 4-6 across two elementary schools located in the capital area. The research team prepared and distributed questionnaires according to the number of students in each school, from grades 4 through 6. The question-naires were then mailed to these schools. Upon receipt, the homeroom teachers of these clas-ses took responsibility for distributing the questionnaires to their respective students. All re-sponses were kept anonymous to ensure the privacy of the participating students. Once the students completed their questionnaires, the teachers gathered them. This method of data col-lection was chosen as it allows for a relatively easy and efficient method of gathering a large amount of data from a specific target group. The use of homeroom teachers to distribute and collect the questionnaires provided a familiar point of contact for the students, which poten-tially increased their willingness to participate and honesty in their responses. The basic char-acteristics(gender, grade) of the students to be studied are as shown in <Table 1>.

Table 1. Characteristics of the participants.

Characteristic	Classification	Frequency(N)	Ratio(%)
Gender	Male	246	53.9
	Female	209	45.8
	Non-responsive	1	0.2
Grade year	4	187	41.0
	5	141	30.9
	6	126	27.6
	Non-responsive	2	0.4

2.3. Measurement tools

The measurement tools of the ADHD tendency, friend support, and emotional problems such as depression and anxiety of the participant were as follows.

2.3.1. ADHD tendency

In this study, Choi's ADHD tendency measurement tool designed for elementary school students was utilized[21]. This scale comprises a total of 18 statements, addressing attention deficit and hyperactivity/impulsivity, and employs a 4-point scale for evaluation. The Cronbach's alpha, a measure of reliability, for each sub-area of the ADHD tendency validated in this study was .787 for attention deficit, .842 for hyperactivity/impulsivity, and .886 for the overall scale. The average inattention and hyperactivity/impulsiveness scores of the study participants, based on a total possible score of 36 points, were 15.478(SD=4.564) and 15.993(SD=5.190) respectively.

Table 2. ADHD tendency of the participants.

	Mean	SD	Maximum	Minimum
Inattention	15.478	4.564	36	9
Hyperactivity/ impulsiveness	15.993	5.190	34	9

2.3.2. Friend support

In this study, to measure the level of friend support for elementary school students, the friend support statements from the Student Social Support Scale by Nolten were utilized[22]. This scale consists of a total of 9 statements and uses a 4-point scale for self-evaluation. The score was calculated inversely, and the higher the total score, the lower the level of friend support. The average friend support score of the study participants, based on a total possible score of 36 points, was 18.050(SD=6.685). The Cronbach's alpha of the friend support scale used in this study, was found to be .930.

Table 3. Friend support of the participants.

	Mean	SD	Maximum	Minimum
Friend support	18.050	6.685	36	9

2.3.3. Emotional problems: depression and anxiety

In this study, to measure the emotional problems such as depression and anxiety level of elementary school students, depression and anxiety-related questions from the Korean version of the Simplified Mental Diagnosis Test by Kim, Won, Lee, and Kim were utilized[23]. This scale consists of 13 statements for depression and 10 statements for anxiety, and employs a 4-point scale for self-evaluation. The Cronbach's alpha of the scale used in this study, was found to be .939 for depression and .930 for anxiety. In terms of the average scores of the study participants, depression was 19.698(SD=8.156) based on a total possible score of 52 points and anxiety was 14.238(SD=5.943) based on a total possible score of 40 points.

Table 4. ADHD tendency of the participants.

	Mean	SD	Maximum	Minimum
Depression	19.698	8.156	52	13
Anxiety	14.238	5.943	40	10

2.4. Data analysis

In this study, the collected data were analyzed using a structural equation model, with the analysis process and procedure conducted as follows. First, a descriptive and correlation analysis were carried out to determine if there were issues with the assumptions of normality among the measured variables. Second, a model fit analysis was conducted to validate the proposed research model. Third, a path analysis was performed to confirm the effects among the variables within the research model. Fourth, an effects decomposition was carried out to discern the total, direct, and indirect effects of ADHD tendencies on friend support and emotional problems. Lastly, to discover the pathway through which ADHD tendencies affect emotional problems via friend support, we set up phantom variables and conducted a mediation analysis using boot-strapping.

3. Research Results

3.1. Correlation and descriptive analysis

As a result of analyzing the correlation between measurement variables, it was found that there was a positive correlation between all measurement variables, as shown in <Table 5>. Next, a descriptive analysis was conducted to find out whether the normality assumption was met, and both figures were found to have no problem with normality, with absolute values 0-2 for skewness and 0-3 for kurtosis.

Table 5. Descriptive statistics and correlations of the measurement variables.

	Inattention	Hyperactivity impulsiveness	Friend support1	Friend support2	Depression1	Depression2	Anxiety1	Anxiety12
Hyper A. impulsiveness	.671**							
F. support1	.264**	.152**						
F. support2	.265**	.149**	.824**					
Depression1	.460**	.305**	.265**	.230**				
Depression2	.514**	.355**	.317**	.293**	.839**			
Anxiety1	.500**	.394**	.267**	.244**	.740**	.783**		
Anxiety1	.508**	.426**	.301**	.275**	.665**	.715**	.803**	
M	1.798	1.723	1.972	2.029	1.557	1.485	1.457	1.411

SD	.592	.504	.795	.747	.644	.661	.635	.629
Skewness	.647	.778	.663	.648	1.330	1.568	1.523	.754
Kurtosis	-.025	.767	-.081	.169	1.372	2.187	1.913	2.782

Note: **p<.01.

3.2. Model fit analysis

Following a model fit analysis conducted to determine whether a research model, established through previous research analysis, could be adopted, a $\chi^2(22)=27.564$ was found, as shown in <Table 6>. The χ^2 index is sensitive to the number of cases; therefore, additional fitness indices were analyzed for a more comprehensive assessment. All of these were found to be within acceptable ranges, thus verifying that the research model set up in this study is suitable.

Table 6. Model fit indices.

Research model	χ^2	df	p	GFI	CFI	TLI	RMSEA
	27.564	22	.016	.985	.995	.989	.046

3.3. Path analysis

A path analysis was conducted between potential variables in the research model to determine significant relationships among ADHD tendency, friend support, depression, and anxiety. As demonstrated in <Table 7>, except for the path of friend support → anxiety, all paths were found significant as follow: ADHD tendency → friend support, ADHD tendency → depression, ADHD tendency → anxiety, friend support → depression, and depression → anxiety. This implies that higher ADHD tendency in a child is linked to lower friend support and increased levels of depression and anxiety. Lower friend support levels were correlated with higher depression and anxiety. The path coefficient values between ADHD tendency, friend support, depression, anxiety, and other measurement variables in the research model are illustrated in <Figure 2>.
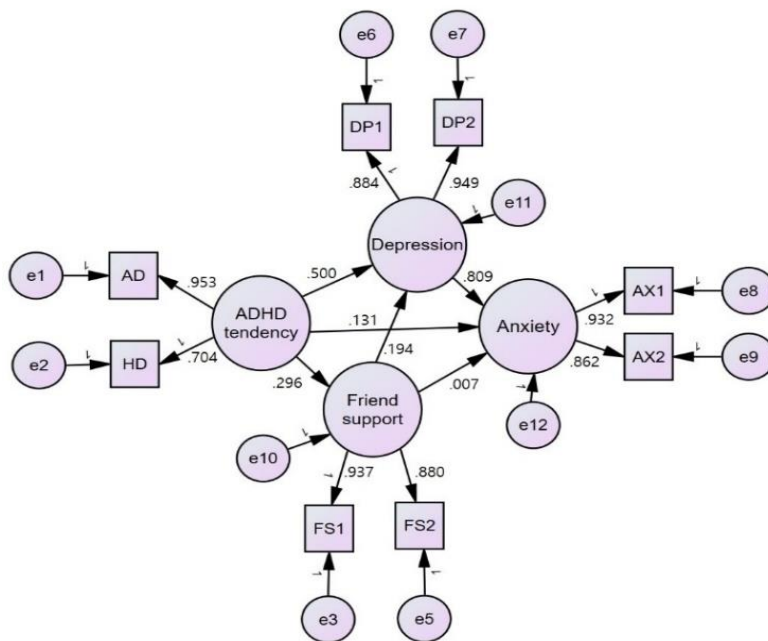
Table 7. Analysis of path coefficients between latent variables.

Pathway	Non-standardized coefficient	Standardized coefficient	Standard error	t
ADHD tendency → friend support	.391	.296	.071	5.531***
ADHD tendency → depression	.505	.500	.059	8.568***
ADHD tendency → anxiety	.391	.131	.071	3.283***
Friend support → depression	.149	.194	.036	4.071***
Friend support → anxiety	.005	.007	.230	0.230
Depression → anxiety	.770	.809	.046	16.918***

Note: ***p<.001.

Figure 2. Standardized regression weight between the variables.

Note: AD-attention deficit, HD-hyperactivity/impulsiveness, FS1-friend support1, FS2-friend support2, DP1-dpression1, DP2-dpression2. AX1-anxiety1, AX2-anxiety2.

3.4. Effect decomposition

An effect decomposition analysis was carried out to examine the direct and indirect effects among ADHD tendency, friend support, depression, and anxiety. The analysis results showed that ADHD tendency directly lower friend support and either directly or indirectly heighten depression and anxiety. Furthermore, friend support was found to directly amplify depression, and depression was determined to directly exacerbate anxiety. The direct, indirect, and total effects between each latent variable are outlined in <Table 8>.

Table 8. Results of the effect decomposition.

Pathway	Direct effect	Indirect effect	Total effect
ADHD tendency → friend support	.296*		.296*
ADHD tendency → depression	.500*	.058**	.558*
ADHD tendency → anxiety	.131*	.453**	.584*
Friend support → depression	.194**	-	.194**
Friend support → anxiety	.007	.157**	.165**
Depression → anxiety	.809*	-	.809*

Note: *p<.05. **p<.01.

3.5. Validation of multiple mediation effects

Given that ADHD tendency was found to directly or indirectly escalate depression and anxiety, phantom variables were established for each mediating path to discern the specific routes through which ADHD tendency heightens depression and anxiety. The mediating effect was then verified through bootstrapping. As illustrated in <Table 9>, three paths were found to be significant at a 95% confidence level. Specifically, it was found that the paths of 'ADHD tendency → friend support → depression', 'ADHD tendency → depression → anxiety', 'ADHD tendency → friend support → depression → anxiety' were significant. This indicates that as children's ADHD tendency increases, friend support decreases, subsequently leading to an elevated their level of depression and anxiety.

Table 9. Analysis of the multiple mediation effects.

Pathway	Estimate	SD	*p*	95% confidence interval (lower bounds, upper bounds)
ADHD tendency → friend support → depression	.058	.018	.007	(.035, .092)
ADHD tendency → depression → anxiety	.389	.048	.004	(.327, .499)
ADHD tendency → friend support → depression → anxiety	.045	.014	.008	(.025, .072)

4. Discussion

4.1. Effects of ADHD tendency on friend support

The analysis results show that ADHD tendency reduce the level of friend support. These findings align with several previous studies that have indicated difficulties in the social relationships of students with ADHD[18][19][20]. There are a few interpretations as to why ADHD tendency lower the level of friend support.

First, there's a likelihood that friend relationships deteriorate due to the individual with ADHD failing to recognize changes in others' emotions or behaviors. Maintaining a good friendship requires careful attention to the other person's feelings and actions, and an appropriate response. For instance, children who have had unpleasant experiences may express negative emotions or pain through facial expressions or actions. Their friends notice these changes and strengthen their bonds by providing appropriate comfort and support. However, children with ADHD may fail to offer suitable support or comfort due to attention deficit symptoms, and they may even respond inappropriately to the situation, exacerbating the quality of their friendships. This supposition is supported by studies showing that children with ADHD demonstrate poorer empathy or emotional awareness for others[24][25].

Second, friendships may deteriorate due to the display of problematic behavior associated with ADHD tendency. Hyperactivity and impulsivity, key symptoms of ADHD, are often perceived as problematic behavior at school or home. For instance, hyperactivity may manifest as restlessness during class, and impulsivity can lead to breaking school or class rules. Such behaviors may result in children with ADHD being labeled as 'problem children'. These children might then face exclusion from friendships or even experience bullying. The studies by Lebowitz, indicating that children with ADHD experience more stigmatization[26], and by Winters, Blake, and Chen showing that children with ADHD face more bullying than their peers[27], support this assumption.

4.2. Effects of ADHD tendency on depression and anxiety

According to the analysis results, ADHD tendency increase the level of depression and anxiety. These findings are consistent with the results of several previous studies that show that ADHD students experience more negative emotions such as depression and anxiety[8][9][10]. There are several interpretations of how ADHD tendency increase the level of depression and anxiety.

First, ADHD tendency may lead to more stress and depression and anxiety. Children with ADHD experience more stress in various scenes of life due to the main symptoms of attention deficit, hyperactivity, and impulsivity. For example, ADHD tendency often prevent students from properly participating in school classes and submitting school assignments on time. Even at home, the relationship between parents and brothers is often poor due to ADHD tendency. In this way, children with ADHD tend to experience more stress than ordinary children, which is likely to lead to negative emotions such as depression and anxiety. The study by Choi showing that ADHD symptoms of children have significant relationships with their stress levels supports this assumption[28].

Second, the low emotional coping ability of ADHD children is likely to cause depression and anxiety. When anyone experiences unpleasant experiences outside, negative emotions such as depression and anxiety are formed. For example, negative events such as ruining a test or in-juring a leg during exercise make us feel depressed or anxious. Most of these negative emotions are alleviated through appropriate coping behavior. This includes doing favorite hobbies to solve problems when you fail the test, or calling a close friend to talk when it is difficult to exercise due to a leg injury. In the case of children with ADHD, when they experience these negative events, they are unable to find a way to properly relieve stress, which may increase depression or anxiety. Barra and her colleague's study, which shows that children with ADHD have less ability to cope with stress than ordinary children, supports this assumption[29].

4.3. Effects of ADHD tendency on depression and anxiety through the mediation of friend support

According to the analysis results, ADHD tendency were found to influence depression and anxiety through the mediation of friend support. Specifically, three statistically significant pathways were identified: first, ADHD tendency deteriorating the level of friend support, which in turn increases depression; second, ADHD tendency directly increasing depression, and the heightened depression further escalating anxiety; third, ADHD tendency deteriorating the level of friend support, leading to increased depression, and the heightened depression then further escalating anxiety. These findings corroborate several previous studies that suggest ADHD tendency can exacerbate social relationships and elevate levels of depression, while also demon-strating the structural relationships between each variable. The speculated reasons for these pathways are as follows.

First, it is possible that ADHD tendency impair social relationships such as friend support, and such deteriorated support acts as stress, resulting in depression and anxiety. The period of ele-mentary school marks the beginning of formal education, and it's a time when children form serious social relationships with peers beyond their parents. Therefore, in elementary school, establishing friendships becomes a critical task. Not being able to form friendships effectively can be stressful. In the case of children with ADHD, they may experience stress due to difficulties in forming friendships, which could lead to depression.

Second, there is a possibility that ADHD tendency worsen friend relationships, which in turn negatively affects school and other social life aspects, and the resultant stress leads to depres-sion and anxiety. According to Ladd's study, peer relationships in school have a significant influ-ence on school adaptation and learning activities[30]. In recent years, the importance of peer

relationships has been increasingly emphasized as teaching methods that require peer interaction, such as cooperative learning and discussion-based learning, are prioritized. Children with ADHD may experience more difficulties in various aspects of school life and learning activities due to negative peer relationships, and these negative experiences could lead to depression and anxiety.

4.4. Limitations and suggestions

This study has certain limitations and the research results suggest directions for future research. First, there may be an error in the responses because the study participants may not have fully understood the questionnaire. The questionnaire for this study was designed so that participants could read and understand the contents independently. However, some of the study participants may have low reading skills and may have responded without fully understanding the contents of the questionnaire. Further research requires the development and application of tools that can objectively measure ADHD tendency, friend support, depression, and anxiety.

Second, the study is limited by its selected variables. Friend support was chosen as the mediating variable connecting ADHD tendency, depression and anxiety. However, there may be a range of other mediators linking ADHD tendency, depression, and anxiety, beyond friend support. Future studies should consider verifying a more comprehensive structural relationship by introducing other potential mediating variables.

Third, the limited sample size makes it difficult to generalize the research results. Participants were students from two elementary school in the capital area. Therefore, it's challenging to extrapolate the findings of this study to all elementary school students. Future research should aim to generalize the results by including a more diverse and larger sample from various regions.

In this study, the mediating effect of friend support on the impact of ADHD tendencies on emotional problems, such as depression and anxiety, in elementary school students was confirmed. These findings suggest that, in order to develop programs addressing emotional problems in children with ADHD, it is essential to consider why children with ADHD exhibit higher levels of emotional problems. Furthermore, the results highlight the necessity of considering social relationship issues, such as friend support, when addressing the emotional problems of children with ADHD.

5. References

5.1. Journal articles

[1] Dvorsky MR & Langberg JM. A Review of Factors That Promote Resilience in Youth with ADHD and ADHD Symptoms. *Clinical Child and Family Psychology Review*, 19, 368-391 (2016).
[2] Holland J & Sayal K. Relative Age and ADHD Symptoms, Diagnosis and Medication: A Systematic Review. *European Child & Adolescent Psychiatry*, 28, 1417-1429 (2019).
[3] Daley D & Birchwood J. ADHD and Academic Performance: Why Does ADHD Impact on Academic Performance and What Can be Done to Support ADHD Children in the Classroom? *Child: Care, Health and Development*, 36(4), 455-464 (2010).
[4] Polanczyk G & Caspi A & Houts R & Kollins SH & Rohde LA & Moffitt TE. Implications of Extending the ADHD Age-of-onset Criterion to Age 12: Results from a Prospectively Studied Birth Cohort. *Journal of the American Academy of Child & Adolescent Psychiatry*, 49(3), 210-216 (2010).

[5] Bitsko RH & Claussen AH & Lichstein J & Black LI & Jones SE & Danielson ML & Hoenig JM & Jack SP & Brody DJ & Gyawali S & Maenner MJ. Mental Health Surveillance among Children-united States, 2013-2019. *MMWR Supplements*, 71(2), 1-1 (2022).

[7] Sayal K & Prasad V & Daley D & Ford T & Coghill D. ADHD in Children and Young People: Prevalence, Care Pathways, and Service Provision. *The Lancet Psychiatry*, 5(2), 175-186 (2018).

[8] Kitchens SA & Rosén LA & Braaten EB. Differences in Anger, Aggression, Depression, and Anxiety Between ADHD and Non-ADHD Children. *Journal of Attention Disorders*, 3(2), 77-83 (1999).

[9] Daviss WB. A Review of Co-morbid Depression in Pediatric ADHD: Etiologies, Phenomenology, and Treatment. *Journal of Child and Adolescent Psychopharmacology*, 18(6), 565-571 (2008).

[10] Paek SH & Abdulla AM & Cramond B. A Meta-analysis of the Relationship between Three Common Psychopathologies -ADHD, Anxiety, and Depression- and Indicators of Little-c Creativity. *Gifted Child Quarterly*, 60(2), 117-133 (2016).

[11] Grünwald J & Schlarb AA. Relationship between Subtypes and Symptoms of ADHD, Insomnia, and Nightmares in Connection with Quality of Life in Children. *Neuropsychiatric Disease and Treatment*, 13, 2341-2350 (2017).

[12] Visser L & Linkersdörfer J & Hasselhorn M. The Role of ADHD Symptoms in the Relationship between Academic Achievement and Psychopathological Symptoms. *Research in Developmental Disabilities*, 97, 103552-103552 (2020).

[13] Weiss MD & Baer S & Allan BA & Saran K & Schibuk H. The Screens Culture: Impact on ADHD. *Attention Deficit and Hyperactivity Disorders*, 3, 327-334 (2011).

[14] Dalsgaard S & Nielsen HS & Simonsen M. Consequences of ADHD Medication Use for Children's Outcomes. *Journal of Health Economics*, 37, 137-151 (2014).

[15] Jung KH & Ahn DH & Kim JY & Kim HJ & Bang YW. A Practice Patterns of Child and Adolescent Psychiatrists in South Korea. *Journal of the Korean Academy of Child and Adolescent Psychiatry*, 25(1), 6-13 (2014).

[16] Park J & Lee DY & Kim C & Lee YH & Yang SJ & Lee S & Kim SJ & Lee J & Park RW & Shin Y. Long-term Methylphenidate Use for Children and Adolescents with Attention Deficit Hyperactivity Disorder and Risk for Depression, Conduct Disorder, and Psychotic Disorder: A Nationwide Longitudinal Cohort Study in South Korea. *Child and Adolescent Psychiatry and Mental Health*, 16(1), 1-9 (2022).

[17] Cascade E & Kalali AH & Wigal SB. Real-world Data on: Attention Deficit Hyperactivity Disorder Medication Side Effects. *Psychiatry*, 7(4), 13-13 (2010).

[18] Wehmeier PM & Schacht A & Barkley RA. Social and Emotional Impairment in Children and Adolescents with ADHD and the Impact on Quality of Life. *Journal of Adolescent Health*, 46(3), 209-217 (2010).

[19] Humphreys KL & Galán CA & Tottenham N & Lee SS. Impaired Social Decision-making Mediates the Association between ADHD and Social Problems. *Journal of Abnormal Child Psychology*, 44, 1023-1032 (2016).

[20] Harpin V & Mazzone L & Raynaud JP & Kahle J & Hodgkins P. Long-term Outcomes of ADHD: A Systematic Review of Self-esteem and Social Function. *Journal of Attention Disorders*, 20(4), 295-305 (2016).

[21] Choi JO. ADHD Symptoms and Off- and On-line Bullying Victimization of Elementary School Students. *The Journal of Special Children Education*, 14(3), 191-210 (2012).

[23] Kim K & Won H & Lee J & Kim K. Standardization Study of Symptom Check List-90 in Korea I: Characteristics of Normal Responses. *Journal of the Korean Neuropsychiatric Association*, 17(4), 449-458 (1978).

[24] Factor PI & Rosen PJ & Reyes RA. The Relation of Poor Emotional Awareness and Externalizing Behavior among Children with ADHD. *Journal of Attention Disorders*, 20(2), 168-177 (2016).

[25] Conway F. Current Research and Future Directions in Psychodynamic Treatment of ADHD: Is Empathy the Missing Link?. *Journal of Infant, Child, and Adolescent Psychotherapy*, 14(3), 280-287 (2015).

[26] Lebowitz MS. Stigmatization of ADHD: A Developmental Review. *Journal of Attention Disorders*, 20(3), 199-205 (2016).

[27] Winters RR & Blake JJ & Chen S. Bully Victimization among Children with Attention deficit/Hyperactivity Disorder: A Longitudinal Examination of Behavioral Phenotypes. *Journal of Emotional and Behavioral Disorders*, 28(2), 80-91 (2020).

[28] Choi JO. ADHD Symptoms and Stress Level and Stress Response Behavior of Elementary School Students. *The Journal of Special Children Education*, 15(1), 267-291 (2013).

[29] Barra S & Grub A & Roesler M & Retz-Junginger P & Philipp F & Retz W. The Role of Stress Coping Strategies for Life Impairments in ADHD. *Journal of Neural Transmission*, 128, 981-992 (2021).

5.2. Books

[22] Nolten PW. Conceptualization and Measurement of Social Support: The Development of the Student Social Support Scale. The University of Wisconsin-Madison (1994).

[30] Ladd GW. Having Friends, Keeping Friends, Making Friends, and Being Liked by Peers in the Classroom: Predictors of Children's Early School Adjustment?. In Interpersonal Development. Routledge (2017).

5.3. Additional references

[6] https://www.nhis.or.kr/ (2023).

6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Author	JC	-Set of concepts ☑
		-Design ☑
		-Getting results ☑
		-Analysis ☑
		-Make a significant contribution to collection ☑
		-Final approval of the paper ☑
		-Corresponding ☑
		-Play a decisive role in modification ☑
		-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑
		-Participants in Drafting and Revising Papers ☑
		-Someone who can explain all aspects of the paper ☑

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Understanding the Role of Parkinson's Disease Nurse Specialists in Providing Personalized Care for Individuals with Parkinson's and Their Families

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Abstract

Purpose: Parkinson's Disease Nurse Specialists(PDNS) play a vital role in delivering personalized care to individuals affected by Parkinson's disease(PD) and their families. This paper explores the multifaceted responsibilities of PDNS in managing and providing comprehensive care for the unique needs of PD patients. Additionally, it delves deeper into the specialized qualifications and training opportunities available for PDNS, with a particular focus on the United Kingdom's National Health Service(NHS).

Method: A systematic review of literature and publications from reputable sources, including PubMed, The Lancet, Parkinson's Europe, and Parkinson's UK, has been conducted to gather pertinent information and insights regarding the crucial role of PDNS in enhancing the quality of life for PD patients. It also includes reviewing the latest PDNS learning pathway guidelines and the EU's PD care manifesto.

Results: A growing number of PD patients and families face communication difficulties with healthcare professionals, particularly consultants. There is a lack of awareness about the disease and its symptoms, which results in delayed diagnosis and inconsistent care plans. During consultations, there is a mismatch between the information provided and the information desired. Publications emphasize the critical roles of PDNS in the delivery of personalized care plans, emphasizing the importance of effective patient-provider communication for optimal plans.

Conclusion: Effective communication and understanding of PD patients' and their family members' circumstances and emotional well-being contribute to informed care plans. PDNS play diverse roles in providing comprehensive patient and family support. They serve as primary contacts, walking alongside patients in their PD journey. It is vital for PDNS to cultivate a trusted relationship and receive ongoing support to enhance their skills. Government and charities hold critical roles in raising awareness and creating learning opportunities for PDNS and healthcare professionals. Research shows low shared decision-making in European PD care plans, leading to treatment inconsistencies. The European Union recognizes the importance of funding further research, stressing knowledge sharing for well-informed and standardized care plans, benefiting PD patients and families.

Keywords: **Parkinson's Nurse Specialist, PDNS, Personalized PD Care, Parkinson's Care Plans, TCM in Parkinson's**

1. Introduction

Parkinson's Disease(PD) was first described by Dr. James Parkinson in 1817. He first described the symptoms related to "the shaking palsy" as he named the disorder[1]. It manifests with a progressive deterioration of motor and non-motor functions, causing tremors, rigidity, postural instability, pain, anxiety, and depression[2].

PD affects individuals of all ages, races, and cultures, with a higher prevalence in those over 60 years old, and a smaller proportion occurring in individuals under 50[3]. It presents with a wide range of motor and non-motor symptoms, impacting the quality of life for patients and their families[4]. PD needs long-term, individualized management because it presents in various ways. Patients are typically more satisfied when treated by a PD specialist than a general neurologist[5]. Therefore, the European Parkinson's Disease Association(EPDA) highlights the pressing need for tailored care plans to address the diverse challenges faced by People with Parkinson's(PwP) and their families and caregivers.

While PD remains incurable, medical and non-medical interventions can help slow its progression and improve patients' quality of life[6]. Developing care plans tailored to each patient's specific needs is essential to ensure the best possible outcomes[7]. The EPDA, the leading Parkinson's association in Europe, addresses various challenges faced by people with Parkinson's(PwP) and their caregivers in their research initiative 'My PD Journey.' These challenges include timely diagnosis, limited accessibility to advanced care, the need for research resources, and increased awareness of the disease's impact. Recognizing these challenges will contribute to better care delivery, thus improving the quality of life for patients and their support networks[8].

1.1. Definition of personalized care

Personalized care is a collaborative process between healthcare providers and patients. It is often needed in 'chronic condition management[9],' wherein healthcare providers and patients identify the symptoms and difficulties caused by their conditions and develop a tailored plan for addressing these issues. At the core of personalized care, there are a series of conversations where both parties are actively involved and being listened to.

People with long-term illnesses, such as Parkinson's, play an important role in monitoring and managing their conditions. This involves monitoring physical, psychological, sensory, or cognitive limitations[10], and it can be complicated and often requires confidence and knowledge from the patients and their families. Healthcare providers are responsible for developing strategies to engage, support, and empower people with long-term conditions so that they can remain the active party in improving their daily lives[9].

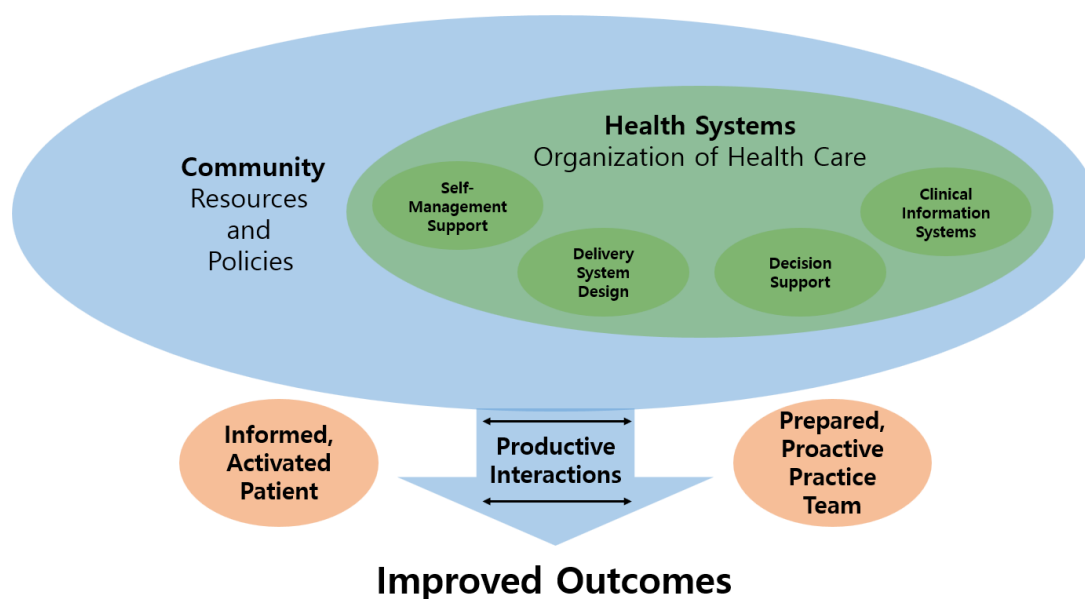## 1.2. The importance of patient empowerment

21 years ago, in 2002, in his report entitled 'Securing our Future Health: Taking a Long-Term View,' Wanless highlighted the importance of self-care over the next 20 years. He argued that self-care would be one of the best examples of how a 'partnership between the public and the healthcare service can work.' Healthcare providers can support the promotion of healthcare by providing patients, as well as the general public, with appropriate information, skills, and equipment to take a more active role in the diagnosis, treatment, and maintenance of well-being[11]. Parkinson's Europe recommends taking a couple of weeks to cool off after their initial diagnosis and then revisiting healthcare providers to ask any questions they may have. Since PD is a highly individual and personal condition that everyone experiences differently, the organization encourages PwP and their caregivers to learn to embrace change, adapt, and take active roles in self-care. For instance, an analogy is used involving playing golf: rather than playing the usual 18 holes, it is advised to play nine holes, opt for a shorter walk than usual, and make healthier dietary choices to lead a fulfilling and high-quality life.

Studies have suggested that patients who actively engage in managing their illnesses(i.e., recognizing their roles in self-managing their conditions and being better informed about their conditions and symptoms, which boosts their confidence to do so) experience improved health and a better quality of life[12][13]. Empowering patients with skills and knowledge for self-managing their conditions will not only enhance their health conditions and general well-being but also have positive effects on the economy. In his 2001 letter to the United Kingdom(UK) Chancellor, Wanless emphasized that the UK's healthcare system was lagging behind other

countries due to budget constraints and poor spending. He also highlighted the challenges posed by an aging society and underscored how providing better healthcare for older individuals can positively impact the national economy[11].

Several organizations have introduced models for managing chronic illnesses; however, "The Chronic Care Model(CCM)[14]," proposed by the Center for Accelerating Care Transformation(ACT Center) in Washington DC in collaboration with the American College of Physicians(ACP), has had the most significant global impact. This model emphasizes the relationship between patients and healthcare providers while highlighting the imperative of overhauling existing care plans for individuals with long-term illnesses, as shown in <Figure 1>. The proposed shift moves away from a predominantly reactive system, where responses are triggered only when a person's condition worsens, to a proactive and holistic approach that investigates the root causes of changes. The model encourages active patient participation, enhancing their understanding of their conditions and empowering them with a stronger voice in the decision-making process related to their care plans. The responsibility of healthcare providers lies in equipping patients with the knowledge, skills, and confidence for self-managing their health conditions[15][16][17]. At the core of the CCM, meaningful conversations take place, with proactive and empathetic healthcare providers ensuring that patients are actively engaged and motivated to participate. With increasing life expectancy, a growing number of individuals will encounter chronic illnesses, necessitating specially tailored approaches to integrate unique needs and symptoms into their care plans.

Figure 1. The chronic care model, by the American college of physicians(ACP)[14]. Developed by the center for accelerating care transformation(ACT center), formerly known as the MacColl center for health care innovation.

The ACT Center emphasizes the significance of patient empowerment and values the involvement of patients and their families as partners rather than merely recipients of care. The center summarizes that when healthcare providers acknowledge the importance of connecting with patients and attentively listening to their stories with empathy, they will develop a deeper understanding of the underlying issues and gain more informed insights into how to effectively address them.

1.3. The importance of parkinson's disease nurse specialists in personalized care

Parkinson's Disease Nurse Specialists(PDNS) play crucial in providing individualized care for those impacted by PD and their families. PDNS are specialized nurses with advanced training

beyond basic qualifications, addressing unique needs of PD patients, offering varied responsibilities like pharmacotherapy and emotional support, following a 'biopsychosocial approach' first established by Rosemary Maguire in the UK in 1989[18]. Across different countries, the qualifications, prerequisites, and job designations for these specialized nurses differ notably. In the UK, their diverse responsibilities encompass a range of tasks, such as aiding patients and caregivers, delivering specialized nursing expertise, offering education and financial guidance, and overseeing care coordination, including referrals and advance care strategizing[19].

Across different countries, the qualifications, prerequisites, and job designations for these specialized nurses differ notably. In the UK, their diverse responsibilities encompass a range of tasks, such as aiding patients and caregivers, delivering specialized nursing expertise, offering education and financial guidance, and overseeing care coordination, including referrals and advance care strategizing[20]. Serving as the primary point of contact for PD patients and their families, PDNS walk alongside them throughout their PD journey. It is vital for PDNS to cultivate a trusted relationship and to receive ongoing support to continue enhancing their knowledge and skills to help educate and empower their patients.

Government organizations and charities hold critical roles in raising awareness and creating environments where continuous learning opportunities are available for PDNS and other healthcare professionals. Research has revealed that shared decision-making remains low in PD care plans across Europe, resulting in inconsistencies in treatment approaches. The EU recognizes the importance of funding further research and emphasizes the necessity of sharing knowledge and experiences to facilitate the implementation of more well-informed and standardized care plans for PD patients and their families.

Nonetheless, it wasn't until 2017 that specific nursing protocols for PD were established[8]. Furthermore, due to the limited availability of PDNS, patients across Europe typically experience waits exceeding 4 months before being able to consult with them[5]. Hence, this research aims to investigate the state of PD care in Europe, including the UK where PDNS was initially introduced, and deliberate on the potential trajectory for advancing PD care.

2. Examining the Current Situation of Parkinson's Disease Care in Europe

2.1. Inconsistencies in parkinson's disease care

The EPDA's 'My PD Journey' research initiative led by experts including Professor Ray Chaudhuri MD FRCP DSC, highlights inconsistencies in available therapies and treatments for PD patients across the European Union(EU)[3]. This lack of consistency often hinders access and developing personalized care for PwP. Personalized care plans that cater to the unique needs of PwP and their families are crucial for managing PD effectively[2]. It is also important to address that PD is affected by the emotional state of the PwP, and the demand is continuous therefore an individual adaptation of the medication is highly recommended[2].

The EPDA's research project, "The subjective experience of Parkinson's disease: A qualitative study in 60 people with mild to moderate Parkinson's in 11 European countries," aimed to identify gaps in Parkinson's care and seek out national examples of good practice that could be applied in other regions. The research was conducted by an independent organization on behalf of EPDA, and was presented to the EU's stakeholders and decision-makers in Brussels in April 2015. The initiative included a qualitative research study that involved in-depth interviews with 60 individuals with Parkinson's in 11 European countries, including Denmark, France, Germany, Hungary, Ireland, Italy, Netherlands, Slovenia, Spain, and the United Kingdom. All participants were in the mild to moderate stage of the disease and were able to participate in the interviews without relying on others[21].

2.2. Delay in diagnosis: understanding the experiences of people with parkinson's

PD is the second most common neurodegenerative disorder, and the number of patients is projected to double over the next generation, making PD one of the leading causes of neurological disability globally[22][23]. Significant progress has been made in understanding the pathogenesis and epidemiology of PD in different populations. However, the cause of the disease remains enigmatic, and there is no proven cure or preventive therapy.

Accurately and promptly diagnosing PD remains a challenge, particularly when it comes to identifying the disease in its earliest stages[24]. The existing clinical diagnostic criteria and biomarkers do not provide a definitive diagnosis during these initial stages, leading to suboptimal accuracy until the condition fully manifests[25].

When considering the experiences of PwP in the diagnosis process, the majority of participants expressed that they did not seek help immediately, with some waiting for up to two years before seeking medical assistance. The early signs of Parkinson's were often misinterpreted as 'stress or tiredness from a viral illness[21]' or attributed to nerve problems. Tremor, being one of the prominent symptoms associated with Parkinson's, raised concerns among these participants. For example, a participant from Sweden described 'stiffness' resulting from his office job, where he sat at a desk for long hours. On the other hand, another participant from Italy, who had a nephew with Parkinson's, noticed that his symptoms were so different from his nephew's that he did not consider it to be Parkinson's. This particular participant did not experience tremor[21].

In European countries, most participants sought diagnosis from their primary care practitioner. While some were fortunate to receive an early diagnosis and were promptly referred to secondary care by their primary care practitioners, others faced delays as some doctors failed to address the seriousness of their symptoms. For instance, one patient from Ireland waited three years for a correct diagnosis, and his symptoms were often dismissed[21].

In some cases, patients with PD in Slovenia opted for private healthcare due to extended waiting times for diagnosis through the national healthcare system. On the day of diagnosis, patients receive prescribed medication, but concerns were raised about inadequate information regarding medication side effects during the consultation. A Danish participant emphasized since PD is a highly individual disease, there is a need for healthcare professionals to make personalized, more informed decisions rather than generalizing their symptoms[21]. Within a few years of medical therapy, most PwP develop complications and these complications are unpredictable. This also includes psychiatric side effects such as delusions, hallucinations and nightmares[26] when increased in severity, these side effects may pose challenges in providing optimal care[27].

2.3. Communications challenges with specialists

According to the EPDA's latest PD observation study, it is evident that a significant number of patients experienced difficulties in effectively communicating with their healthcare professional, especially the senior consultants. Several participants from Slovenia and Germany reported feeling unheard and dismissed when receiving their PD diagnosis[21]. This first negative experience led them to feel hesitant about openly discussing their feelings and concerns about the disease or asking questions about their symptoms during their follow-up consultations[21]. On the other hand, some participants had more positive experiences, having informative and productive consultations with their specialists, with some consultations lasting over an hour. However it is evident that most participants highly appreciated the presence of a PDNS during their appointments, as they felt more comfortable and at ease discussing concerns and asking questions with the PDNS rather than the consultants[21].

In Sweden, a Swedish nurse named Sunvisson, who worked in a neurological rehabilitation ward during the 1980s, noted that "there was no nursing literature written on PD in the 1980s."

She further addressed her astonishment at observing rapid changes in the mobility of her patients with PD. While some of these changes could be attributed to medication, others remained unexplained[28]. With the endorsement of the ward's administration, Sunvisson was authorized to conduct in-depth interviews with PwPs and their families, to better understand their experiences and their coping strategies for the diminishing mobility and non-motor skills in their daily lives[28].

Sunvisson argues the significance of the nurse's role in fostering a personal connection with PwP and their families. She writes, "An illness is an embodied experience"[28] which permeates every facet of our lives every day. She asserts, "We need to become attuned to this person's rhythm of time...[28]," highlighting this as the foundation upon which personalized PD care can be initiated. She emphasized the importance of the willingness to understand the personal ways in which PwP navigate their illness and monitor the changes in their physical and emotional well-being. Such attributes are crucial in building a sense of trust between PDNS, PwP and their families.

3. The Role of Parkinson's Disease Nurse Specialists

3.1. History of nurse specialists

Extended nursing role was first introduced in the 1940s when American nurse, Frances Reiter, coined the term 'Nurse Clinician' which she used to define a nurse who developed their knowledge and clinical competence beyond that of their 'basic' nursing training, but whilst still continuing ongoing clinical practice[29].

The first nurse specialist for PD, Rosemary Maguire, was appointed in the UK in 1989[18]. She later developed a course at Plymouth University on 'Specialist care of people with Parkinson', for which she received an MBE(Member of the Most Excellent Order of the British Empire)[27]. In 1992, a small team of five PDNSs set up the Parkinson's Disease Society with a mission to improve standards of care for PwP[30].

3.2. Understanding the role of nurse specialists in the United Kingdom and Sweden

Today, PDNS, as well as nurses specializing in neurology, undergo additional training and obtain experiences beyond their foundational nursing qualifications to address the unique needs of PD patients[18]. The specific qualifications, requirements, and job titles for the nurse specialist vary significantly across countries[31].

Notably, within the UK, PDNS holds the responsibility of providing not only pharmacotherapy but also emotional and social support, contributing to what is referred to as a 'biopsychosocial approach' to PD management[19]. Their multifaceted roles encompass numerous functions, including providing support for patients and caregivers, offering educational and financial advice, specialized nursing skills, and coordinating care, which entails referrals and advance care planning[20].

Among the myriad responsibilities undertaken by PDNS, the need for emotional support and empathy emerges as a common theme identified through the focus group studies, constituting critical elements in fostering patient-centeredness for both PwP and their caregivers[32]. Sunvisson's interviews with PD patients and their family members, conducted in Sweden, echo the significant role PDNSs play in assisting patients and caregivers in accepting life-altering changes, setting goals, and strategically planning for the progression of the disease.

Functioning as the primary point of contact for PwP, the PDNS plays the role of guiding them throughout all stages of the disease stages. It is their responsibility to not only understand and connect with patients but also to educate and empower them.

3.3. Training opportunities for PDNS

Until 2017, there were no nursing guidelines in place for PD, and interventions were primarily based on routine clinical practices, as there was not enough evidence to support the benefits of nursing intervention[8]. Consequently, such circumstances resulted in inconsistencies in delivering both standardized and personalized care. Training PDNS is critical in formulating and implementing well-informed and personalized care strategies for PwP and their families. Significantly, patients and their caregivers have emphasized the importance of establishing effective and meaningful communication with PDNS and consultants, as this fosters a better understanding of the disease and facilitates appropriate modifications in the care plan[8].

Given the escalating demand for specialized care, it is imperative to provide support to PDNS in accessing continuous training and learning opportunities. This will aid in further refining their skills and expertise, enabling them to deliver more comprehensive and collaborative care for all those involved in supporting PwP.

However, it is important to note that identifying suitable training opportunities can be challenging for PDNS. To address this issue, Parkinson's UK provides a training program designed for the orientation of new PDNSs. In 2018, Parkinson's UK introduced a fresh learning pathway to guide and recommend areas for additional growth and learning for both novice and experienced PDNSs. The Parkinson's Competency document outlines the necessary expertise and abilities that PDNSs need to possess in order to effectively oversee the care of individuals with PD in various healthcare contexts[20][33].

In addition, Parkinson's UK and the Parkinson's Academy have collaboratively developed a dedicated learning pathway exclusively for PDNS, published in July 2023. This comprehensive roadmap compiles all available professional development resources for PDNS and tailors the learning material according to the nurse's specific band levels. The courses offered within this pathway are aligned with Parkinson's nurse competencies and the National Health Service(NHS) Knowledge and Skills Framework. By emphasizing the importance of continuous learning and development, this pathway aims to ensure the delivery of the highest standard of care for Parkinson's patients and their families[7].

One crucial component of the learning pathway is the inclusion of non-medical prescribing modules. In the UK, nurses, midwives, pharmacists and other allied healthcare professionals(AHPs) who have completed an accredited prescribing course and registered their qualifications are able to prescribe[34].

UK's NHS primarily focuses evidence-based conventional treatment and medications to treat PD. While traditional Chinese medicine(TCM) and complementary and alternative therapies may be used alongside mainstream treatment, they are usually considered as supplementary rather than the primary form of treatment[20]. The regulation of TCM in the UK is overseen by the Association of Traditional Chinese Medicine and Acupuncture(ATCM). Patients who are interested in exploring TCM and other complementary therapies must discuss their options with their healthcare team, including the PDNS to ensure safe and coordinated healthcare. It is the healthcare team's responsibility to advise patients on the potential benefits as well as the risks of incorporating TCM or other alternative medical treatments into their overall treatment plans to help them make informed decisions based on their individual health needs.

The largest charity in the UK dedicated to PD, Parkinson's UK, acknowledges that there is limited scientific evidence suggesting that complementary therapies can slow, stop, or reverse the progression of Parkinson's. Nevertheless, they have received feedback from numerous patients who report positive experiences with complementary therapies[20]. Many of the charity's local groups arrange complementary therapy sessions during their regular meetings, encouraging members to explore these options. However, the charity refrains from endorsing any specific form of therapy and also patients are advised to discuss any additional treatments they intend to incorporate with their healthcare team, while also researching the Medicines and Healthcare products Regulatory Agency(MHRA) to ensure the safety of medicines and medical devices.

The UK government established the Complementary and Natural Healthcare Council(CNHC) to provide support and regulation for certain therapies, including the Alexander technique, aromatherapy, Bowen therapy, massage therapy, reflexology, Reiki, and Shiatsu. However, registration with CNHC remains voluntary, and not all practitioners of these therapies choose to be registered.

PD patients often speak with their primary care practitioner, specialist or PDNS to get advice in finding a suitable therapist. Some people speak to friends, family friends or local charity groups. Some practices offer complementary therapies under NHS and these therapies can include acupuncture, aromatherapy, massage, osteopathy and chiropractic treatments. However not all practices offer such treatments. Primary care practitioner can have training in complementary therapy or can refer patients to a therapist registered on the NHS. The Parkinson's charities in the UK also encourage carers to seek complementary therapies, so they can look after their own physical and mental health.

In 2020, an observational study titled "Traditional and Complementary Medicine in a Nephrology Department: Practitioner Knowledge and Advice" was published on PubMed. This study captures particular interest as it tracked 62 practitioners in Spain, among whom 32.26% had received TCM training across various specialized fields. Furthermore, a 41.93% integrated TCM into their patient care practices, while a substantial 67.74% recommended TCM practitioners to their patients. What stands out is that a significant majority, comprising 62.90%, endorsed the inclusion of TCM in clinical practice. In addition, a substantial 77.42% advocated for adding TCM training into formal health education programs. Interestingly, a 27.42% of practitioners noted patient inquired for more information about TCM, and half of these practitioners were aware of the potential interactions between TCM and conventional treatment modalities[35].

4. Conclusion

In conclusion, the dynamic nature of PD calls for a shift towards personalized management, considering an individual's specific symptoms and characteristics[6]. While the idea of nurse specialists in PD care is relatively new, there's a growing acknowledgment of the crucial roles PDNS play in creating personalized care plans for PwP and their families. Although achieving tailored care plans might seem distant, it could start by cultivating a strong patient-provider relationship. This can involve improving diagnostic conversations to be more personal and compassionate, listening attentively to their needs and changes, observing their environmental influences closely, and more. Echoing Sunvisson's view that an "illness is an embodied experience,"[28], healthcare professionals, especially PDNS, must take a comprehensive approach to address the diverse needs of individuals[36]. To attain this goal, it's essential to provide PDNS with continuous learning and training opportunities. Moreover, establishing standardized nursing guidelines and dedicated learning paths tailored to PD can be instrumental in achieving this vision.

5. References

5.1. Journal articles

[4] Schrag A & Schott JM. Epidemiological, Clinical, and Genetic Characteristics of Early-onset Parkinsonism. *The Lancet Neurology*, 5(4), 355-363 (2006).
[5] Schrag A & Khan K & Hotham S & Merritt R & Rascol O & Graham L. Experience of Care for Parkinson's Disease in European Countries: A Survey by the European Parkinson's Disease Association. *European Journal of Neurology,* 25(12), 1410-e120 (2018).

[6] Bouca-Machado R & Titova N & Chaudhuri KR & Bloem BR & Ferreira JJ. Palliative Care for Patients and Families with Parkinson's Disease. *International Review of Neurobiology,* 132, 475-509 (2017).

[8] Radder DL & Lennaerts HH & Vermeulen H & Van Asseldonk T & Delnooz C & Hagen RH & Munneke M & Bloem BR & De Vries NM. The Cost-effectiveness of Specialized Nursing Interventions for People with Parkinson's Disease: The Nice-PD Study Protocol for a Randomized Controlled Clinical Trial. *Trials,* 21, 1-11 (2020).

[9] Coulter A & Entwistle VA & Eccles A & Ryan S & Shepperd S & Perera R. Personalised Care Planning for Adults with Chronic or Long-term Health Conditions. *Cochrane Database of Systematic Reviews*, 3, n010523 (2015).

[12] Hibbard JH & Stockard J & Mahoney ER & Tusler M. Development of the Patient Activation Measure(Pam): Conceptualizing and Measuring Activation in Patients and Consumers. *Health Services Research*, 39(4p1), 1005-1026 (2004).

[13] Michie S & Miles J & Weinman J. Patient-centeredness in Chronic Illness: What Is It and Does It Matter?. *Patient Education and Counseling*, 51(3), 197-206 (2003).

[15] Epping-Jordan JE & Pruitt SD & Bengoa R & Wagner EH. Improving the Quality of Health Care for Chronic Conditions. *BMJ Quality & Safety*, 13(4), 299-305 (2004).

[17] Wagner EH. Chronic Disease Management: What Will It Take to Improve Care for Chronic Illness?. *Effective Clinical Practice*, 1(1), 2-4 (1998).

[18] Tenison E & James A & Ebenezer L & Henderson EJ. A Narrative Review of Specialist Parkinson's Nurses: Evolution, Evidence and Expectation. *Geriatrics*, 7(2), n46 (2022)*.*

[19] Gibson G. What Can the Treatment of Parkinson's Disease Learn from Dementia Care: Applying a Bio-psycho-social approach to Parkinson's Disease. *International Journal of Older People Nursing,* 12(4), e12159 (2017).

[21] Merritt RK & Hotham S & Graham L & Schrag A. The Subjective Experience of Parkinson's Disease: A Qualitative Study in 60 People with Mild to Moderate Parkinson's in 11 European Countries. *European Journal of Person Centered Healthcare,* 6(3), 4-13 (2018).

[22] Dorsey E & Sherer T & Okun MS & Bloem BR. The Emerging Evidence of the Parkinson Pandemic. *Journal of Parkinson's Disease*, 8(s1), S3-S8 (2018).

[23] Feigin VL & Nichols E & Alam T & Bannick MS & Beghi E & Blake N & Culpepper WJ & Dorsey ER & Elbaz A & Ellenbogen RG & Fisher JL. Global, Regional, and National Burden of Neurological Disorders, 1990-2016: A Systematic Analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, 18(5), 459-480 (2019).

[24] Tolosa E & Garrido A & Scholz SW & Poewe W. Challenges in the Diagnosis of Parkinson's Disease. *The Lancet Neurology*, 20(5), 385-397 (2021).

[25] Rajput AH & Rajput A. Accuracy of Parkinson Disease Diagnosis Unchanged in 2 Decades. *Neurology*, 83(5), 386-387 (2014).

[26] Onofrj M & Thomas A & D'Andreamatteo G & Lacono D & Luciano AL & Di Rollo A & Di Mascio R & Ballone E & Di Iorio A. Incidence of RBD and Hallucination in Patients Affected by Parkinson's Disease: 8-Year Follow-up. *Neurological Sciences*, 23, 31-94 (2002).

[28] Surendranath S. Parkinson's Nurses: A Light in the Darkness. *Nursing Older People,* 26(9), 16-20 (2014).

[29] Reiter F. The Nurse-clinician. *The American Journal of Nursing,* 66(2), 274-280 (1966).

[30] Reynolds H & Wilson-Barnett J & Richardson G. Evaluation of the Role of the Parkinson's Disease Nurse Specialist. *International Journal of Nursing Studies*, 37(4), 337-349 (2000).

[31] Wheeler KJ & Miller M & Pulcini J & Gray D & Ladd E & Rayens MK. Advanced Practice Nursing Roles, Regulations, Education and Practice: A Global Study. *Annals of Global Health,* 88(1), n42 (2022).

[32] Van der Eijk M & Faber MJ & Al Shamma S & Munneke M & Bloem BR. Moving Towards Patient-centered Healthcare for Patients with Parkinson's Disease. *Parkinsonism & Related Disorders,* 17(5), 360-364 (2011).

[33] Brown S & Dalkin SM & Bate A & Bradford R & Allen C & Brittain K & Clarke A & Hand A. Exploring and Understanding the Scope and Value of the Parkinson's Nurse in the UK(The USP Project): A Realist Economic Evaluation Protocol. *BMJ Open*, 10(10), e037224 (2020).

[35] Pedreira-Robles G & Vasco-Gómez A & Martínez-Delgado Y & Herrera-Morales C & Junyent-Iglesias E. Traditional and Complementary Medicine in a Nephrology Department: Practitioner Knowledge and Advice. *British Journal of Nursing*, 29(7), 426-430 (2020).

[36] Ng JS. Palliative Care For Parkinson's Disease. *Annals of Palliative Medicine*, 7(3), 296-303 (2018).

5.2. Books

[1] Stewart A. Parkinson's Disease Diagnosis and Clinical Management, Second Edition. Demos Medical (2008).

[11] Wanless D. Securing Our Future Health: Taking a Long-term View. HM Treasury (2002).

[16] Nolte E & Pitchforth E. Chapter 2. What We Know: A Brief Review of the Evidence of Approaches to Chronic Care. In: Assessing Chronic Disease Management in European Health Systems: Concepts and Approaches. European Observatory on Health Systems and Policies (2014).

[27] Sunvisson H. The Embodied Experience of Living with Parkinson's Disease. Karolinska Institute (2003).

5.3. Additional references

[2] https://www.parkinsonseurope.org/ (2022).

[3] https://www.parkinsonseurope.org/ (2023).

[7] https://www.parkinsons.org.uk/ (2023).

[10] World Health Organization. Prevention and Control of Noncommunicable Disease. 130th Session Provisional Agenda Item 6.1 (2011).

[14] https://www.act-center.org/ (1998).

[20] Parkinson's Disease Nurse Specialist Association. Competencies: A Competency Framework for Nurses Working in Parkinson's Disease Management Parkinson's UK 2016 3rd Edition (2016).

[34] https://www.rcn.org.uk/ (2023).

6. Appendix

6.1. Author's contribution

	Initial name	Contribution
Lead Author	SS	–Set of concepts ☑ –Design ☑ –Getting results ☑
Co-author	HY	–Analysis ☑ –Make a significant contribution to the collection ☑ –Final approval of the paper ☑
Co-author	SP	–Corresponding ☑ –Play a decisive role in modification ☑
Corresponding Author*	MSP	–Significant contributions to concepts, designs, practices, analysis, and interpretation of data ☑ –Participants in Drafting and Revising Papers ☑ –Someone who can explain all aspects of the paper ☑

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