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Influence of Sleep Quality, Coffee Consumption, and Perceived Stress on the Incidence of Thyroid Cancer in Healthy Korean Adults

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Purpose: This study aimed to examine the influence of lifestyle-related factors, such as sleep quality, eating habits, and perceived stress, on the incidence of thyroid cancer in healthy adults. **Methods:** This study is a cross-sectional case-control study comparing lifestyle-related factors in thyroid cancer and healthy groups. Outpatients with thyroid cancer were recruited from 2012 to 2013, 3~6 months after thyroidectomy at a tertiary hospital in Seoul, Korea (n=468). For the control group, 935 healthy adults were recruited by propensity score matching on demographic characteristics in a 1:2 ratio from hospital health checkup data. The effect of sleep quality, eating habits, and perceived stress on the incidence of thyroid cancer was determined through multiple logistic regression analysis and backward stepwise variable selection. **Results:** Sleep disturbance and mild/moderate daytime dysfunction were found to have a 1.22 and 1.66/1.77-fold influence, respectively, in patients with thyroid cancer than in healthy controls ($p<.05$). Coffee consumers who drink 3~6 times/day showed reduced cancer incidence than those who drink very little (odds ratio=0.53, 95% confidence interval=0.32~0.87). Perceived stress was a significant risk factor in univariate ($p=.004$), but not in multivariate analysis. **Conclusion:** These findings highlight the need for evaluating sleep quality, especially in high-risk adults and patients with thyroid cancer. Preventive measures should be adopted to lower stress levels and improve sleep quality.

Key Words: Lifestyle; Sleep; Coffee; Psychological stress; Thyroid neoplasms

INTRODUCTION

In Korea, the incidence of thyroid cancer was the highest among all cancers in 2009~2014 and the third highest in 2018; it was the sixth and second most common cancer in men (4.6%) and women (18.8%), respectively [1]. Although thyroid cancer is associated with a 100% 5-year survival rate, patients who have undergone thyroidectomy must take lifelong thyroid hormones and undergo long-term follow-up tests to monitor for recurrence, which may cause physical and psychological discomfort [2-4]. Additionally, patients with thyroid cancer are generally in their 40s and 50s when diagnosed, and given the high survival rates, live with thyroid cancer for an extended period [5]. There-

fore, there is a need to improve the quality of life of patients with thyroid cancer. Even though thyroid cancer does not threaten survival itself, there is a possibility of recurrence [2] and the quality of life of patients with thyroid cancer is lowered [6]. Therefore, it is necessary to identify and manage the factors that influence the occurrence of thyroid cancer.

Despite the high cure rates of thyroid cancer, the incidence of the cancer is increasing [1,2]. Therefore, researchers must constantly perform studies to identify the lifestyle risk factors of thyroid cancer and investigate risk mitigation measures for those at increased risk [7]. By 2009, most studies on thyroid cancer in Korea focused on clinical and pathologic characteristics [8]. However, since

2010, many more studies have focused on patients' well-being, educational programs, and interventions; nevertheless, there is a paucity of research focusing on lifestyle-related risk factors [8], which are important in the control or management of other risk factors of thyroid cancer.

Thyroid cancer's risk factors include tubercle size, positive history of thyroid disease, family history of thyroid disease, age, gender, and history of head and neck radiotherapy [9]. Other factors that contribute to the incidence of thyroid cancer include nutrition, eating habits, obesity [10], exposure to environmental radiation, and hormones [11]. Bandurska-Stankiewicz et al. [12], using 297 patients with thyroid cancer, evaluated whether eating habits, alcohol consumption, and smoking habits were associated with increased risk of thyroid cancer. Alcohol and smoking were non-significant, while vegetable consumption was one of the environmental factors associated with an increased thyroid cancer incidence. A study by Lee and Kwak [13] on thyroid cancer risk factors and a prediction model using data from 260 patients with thyroid cancer in the experimental group and 259 Korean women in the control group found that living by the sea, obesity, lack of exercise, occupation, and perceived stress were associated with an increased incidence of thyroid cancer.

Cancer can be prevented through healthier lifestyle choices and detected early by routine screening; rather than being a life-threatening disease, cancer has become a chronic illness, requiring long-term and systematic management [14]. Therefore, there is a need to examine whether factors associated with chronic diseases, such as poor sleep quality [15], unhealthy eating habits [16], and perceived stress [17] have an impact on thyroid cancer incidences.

In this study, we investigate the relationship between sleep quality, eating habits, and stress with thyroid cancer incidences. We provide basic data for primary prevention aimed at predicting and managing patients at a high-risk of developing thyroid cancer.

METHODS

1. Study Design and Participants

This is a cross-sectional case-control study comparing the characteristics of patients diagnosed with thyroid cancer with those of healthy controls. Patients with thyroid cancer who underwent total or single thyroidectomy (n=468) were recruited from the thyroid cancer center of a single tertiary hospital from February 2012 to February 2013.

Since long-term memory problems could affect questionnaire responses [18], patients between three to six months after surgery were targeted. Patients who had undergone surgery within the last two months were excluded since stress and surgical-related discomfort can affect questionnaire responses [19].

The healthy control group (n=935) comprised patients who had undergone health check-ups at the same hospital's health screening center during the same period. The inclusion criteria were patients aged ≥ 18 years, who could read, fill out, and communicate questionnaires, voluntarily signed the consent form, and did not have other types of cancers, hepatitis, thyroid-related disease, high blood pressure, diabetes, dyslipidemia, a history of mental illness, or a family history of cancer. The healthy control group members were propensity-matched concerning demographic characteristics with the patient group at a 1:2 ratio. The sample size was calculated using SPSS Sample Power (version 3.0; IBM, Armonk, NY, USA), based on the study by Hur and Song [20] of 139 cancer patients and 139 healthy adults on perceived stress in cancer patients and healthy adults (power=80%, $p < .05$).

2. Research Instruments

The tools used in this study are available to the public and therefore do not require separate licenses.

1) Variables For Propensity Score Matching

Independent variables used for Propensity Score Matching (PSM) were gender, age, height, weight, history of other cancer types, underlying thyroid disease, and family history of cancer [2]. Incidence of chronic diseases such as hypertension and diabetes, which may affect lifestyle, and the presence or absence of psychiatric diseases, such as depression and insomnia, were also included.

2) Sleep Quality

We used the Korean version of the Pittsburg Sleep Quality Index, a 19 item self-assessment questionnaire that evaluates sleep quality and disturbances, categorized into seven subareas: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction [21]. The items are assessed on a 4-point Likert scale ranging from 0 ("no difficulty") to 3 ("severe difficulty"). The total score ranges between zero and 57, with higher scores indicating poor sleep quality. Cronbach's α values for the original and current instrument were .83 and .76, respectively.

3) Eating Habits

The food intake frequency questionnaire (revised version, 2004) developed for the Korean Genome and Epidemiology Study conducted by the Korea National Institute of Health to assess long-term nutrition intake was used [22]. Under the assumption that adults' eating habits remain constant, this questionnaire examines the average frequency and food intake level per item in the last year. We examined nine items of meal frequency and food intake patterns and five items about beverage intake patterns, including water; the daily food intake frequency was once, twice, or three times a day. As for coffee and beverages, the daily frequency was once a day, two or three times a day, three or four times a day, or more than five times a day.

4) Perceived Stress

A tool used in the Korean Health and Nutrition Survey [23] developed by the Korea Centers for Disease Control and Prevention was used. This tool estimates long-term stress, lasting for a month, rather than acute stress. Therefore, before patients were diagnosed with thyroid cancer, we asked them to respond to the questionnaire on long-term stress. The instrument comprises nine items on perceived stress and one item on stress causes; the nine items include five types of stress reactions: harassment, anger, aggression, tension, and depression. The instrument items were assessed on a 5-point Likert scale (1=never, 2=mild, 3=moderate, 4=severe, 5=extremely severe). The scores ranged from nine to 45, with higher scores indicating a higher level of perceived stress. At the time of development, the tool's Cronbach's α value was .90; in this study, the Cronbach's α was .91.

3. Data Collection

This study was conducted following the principles of the Declaration of Helsinki, and approval was obtained from the ethics committee of K hospital in Seoul before the study (IRB No. KBC 2012-01-014).

In the patient group, experienced nurse researchers collected patient data through face-to-face interviews, after receiving patients' consent. The researchers asked each patient to answer, not according to the present point of view but based on past lifestyle before the patient was diagnosed with thyroid cancer. For the control group, the researchers collected data, acquiring an agreement on using data derived from the participant's health examination from each participant at the Health Examination Center of K hospital. IRB permitted the whole process including the

use of data from the control group.

4. Data Analysis

To ensure homogeneity and causality between the two groups through PSM, all participants were asked to complete the questionnaire the same day. We performed PSM, where both the participants' demographic and clinical characteristics were propensity score-matched in a 1:2 ratio. Data were analyzed using SPSS (version 21.0, Armonk, NY: IBM Corp). Continuous and categorical variables were expressed as means±standard deviation and percentages, respectively. Sleep quality, eating habits, and perceived stress in both groups were compared using the chi-square, or Fisher's exact tests, and independent t-tests. To determine these factors' effects on thyroid cancer, multiple logistic regression analyses using backward stepwise variable selection method were performed, and $p < .05$ was considered significant.

RESULTS

1. Participant Characteristics

The thyroid cancer patient group comprised 128 men (27.4%) and 340 women (72.6%); the healthy control group comprised 250 men (26.7%) and 685 women (73.3%). The mean age of both groups was 44 years; the majority (58.8% among the cancer patients and 61.4% of the healthy control group) of the participants were aged between 30 and 49 years. The average body mass index of the patient and healthy control groups was 24.0 kg/m^2 and 23.8 kg/m^2, respectively; the percentage of obese participants was 34.2% and 35.7%, respectively (Table 1).

2. Comparisons of Sleep Quality, Eating Habits, and Perceived Stress between Groups

As shown in Table 2, the average total hours of sleep per day in the patient and healthy control groups was 6.28 and 6.19, respectively, showing no significant differences between the groups. For subjective sleep quality, the proportion of participants who reported poor sleep was significantly higher in the cancer patient group than in the healthy control group (x^2=10.32, p=.016). The proportion of participants who reported that they had difficulty concentrating during the day because of sleep disturbances was significantly higher in the patient group than the healthy control group (x^2=41.90, p<.001).

According to Table 3, in the healthy control group, the

Table 1. Participants' Characteristics After Propensity Score Matching and Surgical Findings (*N*=1,403)

Variables	Categories	Cancer patients (n=468) n (%) or M±SD	Healthy adults (n=935) n (%) or M±SD	x^2 or t	*p*
Gender	Men	128 (27.4)	250 (26.7)	0.05	.807
	Women	340 (72.6)	685 (73.3)		
Age (year)		44.38±11.17	44.20±11.48	-0.28	.776
Age categories (year)	19~29	31 (6.6)	64 (6.9)	1.15	.561
	30~49	275 (58.8)	574 (61.4)		
	50~87	162 (34.6)	297 (31.7)		
BMI (kg/m^2)		23.95±3.62	23.83±3.61	-0.57	.567
BMI categories (kg/m^2)	<18.50	13 (2.8)	41 (4.4)	2.82	.413
	18.50~22.99	200 (42.7)	382 (40.9)		
	23.00~24.99	95 (20.3)	178 (19.0)		
	≥25.00	160 (34.2)	334 (35.7)		
Surgical findings (n=463)					
Operation method					
Lobectomy		156 (33.7)			
Total thyroidectomy		307 (66.3)			
Tumor size, cm (range 0.2~5.0)		0.91±0.63			
Cell types					
Papillary		459 (99.2)			
Medullary		2 (0.4)			
Papillary and medullary/others		2 (0.4)			
Lymph node metastasis, yes		236 (51.0)			

BMI=body mass index.

Table 2. Comparison of Sleep Quality between Patients with Thyroid Cancer and Healthy Adults (*N*=1,403)

Variables	Categories	Cancer patients (n=468) n (%) or M±SD	Healthy adults (n=935) n (%) or M±SD	x^2 or t	*p*
Total sleep time per day (hour)		6.28±1.30	6.19±1.92	-1.09	.276
Sleep latency (hour) (n=1,339)		0.50±0.59	0.46±0.99	0.94	.174
Sleep disturbance (n=1,396)	(range 0~27)	4.05±3.45	2.72±2.97	6.95	<.001
Subjective sleep quality (n=1,356)	Very good	38 (8.1)	105 (11.8)	10.32	.016
	Fairly good	294 (62.8)	568 (64.0)		
	Fairly bad	113 (24.2)	193 (21.7)		
	Very bad	23 (4.9)	22 (2.5)		
Daytime dysfunction (n=1,353)	No problem at all	171 (36.6)	470 (53.1)	41.90	<.001
	Only a very slight problem	214 (45.6)	334 (37.7)		
	Somewhat of a problem	75 (16.1)	76 (8.6)		
	A very big problem	8 (1.7)	5 (0.6)		
Trouble staying awake in social activity (time/week) (n=1,347)	None	282 (60.2)	583 (66.3)	6.48	.090
	<1	123 (26.3)	184 (20.9)		
	1~2	41 (8.8)	80 (9.1)		
	≥3	22 (4.7)	32 (3.7)		

Table 3. Comparison of Eating Habits between Patients with Thyroid Cancer and Healthy Adults (N=1,403)

Variables	Categories	Cancer patients (n=468)	Healthy adults (n=935)	x^2	p
		n (%)	n (%)		
Frequency of meal intake (times/day) (n=1,128)	1~2	124 (26.5)	201 (30.5)	2.10	.511
	3	308 (65.8)	410 (62.1)		
	Irregular	36 (7.7)	49 (7.4)		
Frequency of eating out (n=1,105)	Rarely eat	233 (49.8)	264 (41.4)	9.52	.023
	<4 times/week	86 (18.4)	117 (18.4)		
	Once/day	89 (19.0)	159 (25.0)		
	≥Once/day	60 (12.8)	97 (15.2)		
Frequency of fast or fried food intake (n=1,158)	Rarely eat	103 (22.0)	123 (17.8)	4.28	.232
	1~3 times/month	296 (63.3)	471 (68.2)		
	Once/day	45 (9.6)	68 (9.9)		
	≥4 times/day	24 (5.1)	28 (4.1)		
Frequency of drinking coffee (n=1,206)	Very little	78 (16.7)	64 (8.6)	18.88	<.001
	<4 times/week	88 (18.8)	163 (22.1)		
	1~2 times/day	216 (46.1)	349 (47.3)		
	3~6 times/day	86 (18.4)	162 (22.0)		

Table 4. Comparison of Perceived Stress between Patients with Thyroid Cancer and Healthy Adults (N=1,403)

Variables	Categories	Cancer patients (n=468)	Healthy adults (n=935)	x^2 or t	p
		n (%) or M±SD	n (%) or M±SD		
Perceived stress level	(range 9~45)	17.73±6.45	16.59±7.21	2.99	.004
Feeling when experiencing stress	Decline in problem-solving capability	2.06±0.94	2.07±1.02	-0.18	.822
	Criticized or judged by others	1.48±0.79	1.45±0.78	0.67	.510
	Mentally tired	2.16±1.03	2.10±1.10	1.00	.359
	Difficulty to relax	2.03±1.02	1.89±1.04	2.40	.017
	Angry	2.16±1.02	1.99±1.03	2.93	.003
	Lose motivation	2.10±0.99	2.00±1.05	1.74	.008
	Nervous	2.36±1.07	2.07±1.08	4.77	<.001
	Destroy something	1.38±0.77	1.34±0.76	0.92	.304
	Think of nothing	2.00±1.11	2.01±1.18	-0.15	.906
Perceived major stressor	Work, job, school	211 (45.2)	380 (40.7)	2.52	.130
	Interpersonal relationships	163 (34.9)	276 (29.6)	4.09	.043
	Changes in interpersonal relationships	19 (4.0)	29 (3.1)	0.86	.352
	Financial problems	34 (7.3)	131 (14.1)	13.67	<.001
	Boredom in daily life/others	41 (8.6)	119 (12.5)	4.85	<.001

proportion of participants who ate out more than once a day and the frequency of coffee intake were significantly higher than the cancer patient group (x^2=9.52, p=.023 and x^2=18.88, p<.001, respectively). The perceived stress scores were significantly higher in the patient group than in the healthy control group (t=2.99, p=.004; Table 4). Concerning the feelings experienced when participants faced stressful situations before diagnosis, a significantly higher proportion of patients reported: "difficulty to relax" (t=2.40, p=.017), "anger" (t=2.93, p=.003), "losing motivation" (t=1.74, p=.008),

or "nervousness" (t=4.77, p<.001) than the healthy control group did (Table 4).

3. Factors Associated with Incidence of Thyroid Cancer

In the bivariate analysis, differences were observed (and adjusted for) between the two groups regarding confounding variables. After entering the variables that significantly influenced intergroup relations, backward multivariate logistic regression was performed, identifying

Table 5. Logistic Regression Analysis of Variables Affecting the Incidence of Thyroid Cancer   (*N*=468)

Variables	Categories	Crude OR		Multivariate OR	
		OR (95% CI)	*p*	OR (95% CI)	*p*
Sleep disturbance		1.21 (1.17~1.26)	<.001	1.22 (1.16~1.27)	<.001
Subjective sleep quality	Very good	1 (reference)			
	Fairly good	1.43 (0.96~2.13)	.077		
	Fairly bad	1.62 (1.04~2.51)	.031		
	Very bad	2.88 (1.45~5.77)	.003		
Daytime dysfunction	No problem at all	1 (reference)			
	Very slight problem	1.75 (1.37~2.24)	<.001	1.66 (1.24~2.21)	.001
	Somewhat of a problem	2.71 (1.88~3.90)	<.001	1.77 (1.11~2.83)	.016
	A very big problem	4.39 (1.42~13.63)	.010	0.95 (0.23~3.90)	.950
Eat out	Very little	1 (reference)			
	<4 times/week	0.83 (0.59~1.15)	.277		
	1~2 times/day	0.63 (0.46~0.86)	.004		
	3~6 times/day	0.71 (0.48~1.01)	.058		
Drinking coffee	Very little	1 (reference)			
	<4 times/week	0.44 (0.29~0.67)	<.001	0.63 (0.38~1.05)	.075
	1~2 times/day	0.51 (0.35~0.73)	<.001	0.67 (0.43~1.05)	.084
	3~6 times /day	0.47 (0.28~0.66)	<.001	0.53 (0.32~0.87)	.013
Perceived stress level		1.02 (1.01~1.04)	.004		

CI=confidence interval; OR=odds ratio.

sleep disturbances, daytime dysfunction, and frequency of coffee intake as significant variables. When the degree of sleep disturbance increased by one level, the odds of developing thyroid cancer increased 1.22-fold (95% Confidence Interval [CI]=1.16~1.27; *p* <.001). Compared with those who experienced no daytime dysfunction, participants who reported "only a minor problem" had 1.66 higher odds of developing thyroid cancer (95% CI=1.24~2.21; *p*=.001), while those who reported "somewhat of a problem" had 1.77 higher odds (95% CI=1.11~2.83; *p*=.016). Compared with those who rarely drank coffee, participants who drank three-six cups of coffee a day had lower odds of developing thyroid cancer (Odds Ratio [OR]=0.53; 95% CI=0.32~0.87; *p*=.013). The crude OR (1.02) of perceived stress was significant (*p*=.004); however, after multivariate logistics regression, the significance was lost. The fit of the logistic regression model was evaluated by the Hosmer Lemshow goodness-of-fit test (*p*=.269), and the explanatory power was determined by C-statistics (0.739, 95% CI; 0.716~0.762)(Table 5).

DISCUSSION

We investigated the relationship between thyroid cancer and daily lifestyle-related variables, such as sleep quality, eating habits, and perceived stress among adults with

no risk factors for thyroid cancer-history of thyroid cancer, family history of cancer, and thyroid-related illnesses-and with no chronic diseases. In this study, we found that sleep disturbances and perceived stress influence thyroid cancer, while coffee intake may mitigate against its development. Poor sleep quality and stress were also highlighted.

In this study, 27.4% of the participants were men and 72.6% women, consistent with the previously reported men/women thyroid cancer patient ratio of 0.3:1 [2]. The average age of the participants was 44 years, similar to findings of a previous study [24], showing that thyroid cancer incidences among Koreans rise dramatically in the age group of 35~64. The obese people percentage in this study was 34.2%, nearly the same as the obesity rate 34.1%, among people older than 19 years old from the survey conducted by the Korean Statistical information service in 2016 [16].

Sleep quality, sleep disturbance, and daytime dysfunction significantly differed between the patient and healthy control groups. This finding supports the World Cancer Report, showing that shiftwork was a risk factor for cancer [25] and that the risk of developing cancer increases with poor sleep quality and shorter sleep duration [26,27].

Between the patient group with thyroid cancer and the control group, a statistically significant difference was found in the frequency of dining out. However, in this

study, there is no investigation into which aspect has affected thyroid cancer except the frequency of dining out. Therefore, a deeper, further study on this subject is needed. Bandurska-Stankiewicz et al. [12] reported that eating habit affects health status among patients who are suffering from thyroid cancer. However, according to Choi and Kim [28], who analyzed 27 studies published between 1995 to 2014, each research result had no consistency on the whole. Eating habits comprise a variety of diet-related factors. Preventive interventions should consider what eating factors affect thyroid function through altering thyroid hormone levels.

This study found that perceived stress was significantly higher in the patient group. This finding supports a previous study [13] of 259 Korean women with thyroid cancer, showing that stress is a risk factor for thyroid cancer. Over 40% of participants in both groups in this study reported that their major stressors are associated with work, job, and study. Unfortunately, perceived stress was not associated with the incidence of thyroid cancer in the multivariate analysis of this study, but a further investigation about the relationship of stress with thyroid cancer is needed. However, a previous study reported that stress at the workplace was the principal risk factor for colon, lung, and esophageal cancers and that stress increased cancer incidences in employees with work-related stress [29]. Stress influences not only cancer incidences but also the treatment course for cancer and the quality of life of cancer patients, resulting in poor quality of life and fear of recurrence among cancer patients [3]. Therefore, healthcare providers should periodically evaluate the stress of adults at high-risk of thyroid cancer or patients with thyroid cancer who have undergone surgery at outpatient visits, and develop and provide nurse-led relaxation therapy or counseling programs.

Multivariate analyses showed that when sleep level disturbance increased by one level, the odds of developing thyroid cancer increased by 1.22-fold. Sillah et al. [27] found that patients with severe obstructive sleep apnea were more likely to develop cancer than those with less severe obstructive sleep apnea. In 2016, Phipps et al. [26] found that sleep disturbance decreased survival rates of breast cancer patients by 1.34-fold. These findings suggest that sleep disturbance can increase the incidence and survival rates of cancer patients; thus, we must endeavor to identify and improve sleep disturbance risk factors. Compared to participants who did not experience daytime dysfunction, those who reported "only a minor problem" had 1.66 higher odds of developing thyroid cancer, and those who reported "somewhat of a problem" had 1.77 higher

odds. In a previous study of patients with chronic insomnia, it was found that daytime sleepiness, low quality of sleep, and perceived stress lowered functional health [30], therefore, more attention is needed for sleep quality in high-risk patients with thyroid cancer.

The higher consumption frequency of coffee in the healthy control group is consistent with the findings of case-control studies by Lee and Kwak [13] and Przybylik-Mazurek et al. [31], in which coffee consumption was significantly associated with thyroid cancer incidences. The odds of developing thyroid cancer decreased by a factor of 0.53 among those who drank three-six cups of coffee a day, compared with those who rarely drank coffee. This is consistent with the findings of a previous meta-analysis, demonstrating that the odds of developing liver cancer decreased two-fold among those who drank a large amount of coffee [32], and a study where coffee consumption decreased the risk of liver and endometrial cancer development; however, inconsistent results have been found concerning the relationship between stomach, pancreatic, lung, and ovarian cancer incidences and coffee consumption [32-34]. Since previous studies have shown contradictory effects of coffee consumption on the occurrence of thyroid cancer, repeated studies considering the type of thyroid cancer, demographic characteristics of the subject, and the amount of caffeine contained in coffee are needed in the future. This can be used as basic data for clinical education to educate patients on the effects of caffeine intake.

Our study's strength is that we determined how sleep quality, eating habits, and perceived stress before receiving cancer diagnosis influenced the incidence of thyroid cancer among those with no risk factors through a PSM analysis. However, our study has several limitations: first, we conveniently selected participants from patients with thyroid cancer at a hospital; therefore, the findings may not apply to all Korean patients with thyroid cancer. Second, participants had to rely on their memory when filling out the questionnaire before receiving their diagnosis, thereby increasing the risk of recall bias. Finally, participants' socioeconomic status such as education, occupation, and income were not identified, and their impact on the risk of thyroid cancer was not controlled for.

CONCLUSION

Poor sleep quality and low consumption of caffeine-containing beverages were identified as significant predictors of thyroid cancer. Both predictors and relevance can be used to understand patients with thyroid cancer, with a provision of basic data on therapy and preventive

nursing. Intervention programs for enhancing sleep quality and managing coffee intake habits among at-risk patients and patients with thyroid cancer needs to be developed. Further studies that control for socioeconomic status and occupation are also required.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORSHIP

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REFERENCES

1. Department of Health and Human Services. Cancer incidence and mortality status [Internet]. Daejeon: Ministry of Health and Welfare; 2018 [cited 2021 February 15]. Available from: http://www.index.go.kr/potal/main/EachDtlPageDetail.do?idx_cd=2770

2. Korean National Cancer Information Center. Thyroid cancer [Internet]. Goyang: Korean National Cancer Information Center; 2018 [cited 2021 February 15]. Available from: https://www.cancer.go.kr/lay1/program/S1T211C212/cancer/view.do?cancer_seq=3341&menu_seq=3360

3. Yoon HJ, Seok JH. Clinical factors associated with quality of life in patients with thyroid cancer. Journal of Korean Thyroid Association. 2014;7(1):62-9. https://doi.org/10.11106/jkta.2014.7.1.62

4. Aschebrook-Kilfoy B, James B, Nagar S, Kaplan S, Seng V, Ahsan H, et al. Risk factors for decreased quality of life in thyroid cancer survivors: initial findings from the North American thyroid cancer survivorship study. Thyroid: Official Journal of the American Thyroid Association. 2015;25(12):1313-21. https://doi.org/10.1089/thy.2015.0098

5. Lee I, Park CS. Convergent effects of anxiety, depression, uncertainty, and social support on quality of life in women with thyroid cancer. Journal of the Korea Convergence Society. 2017; 8(8):163-76. https://doi.org/10.15207/JKCS.2017.8.8.163

6. Lee SY, Kim HK. Structural equation modeling on health-related quality of life among patients with thyroid cancer. Korean Journal of Adult Nursing. 2018;30(2):171-82. https://doi.org/10.7475/kjan.2018.30.2.171

7. Lee TG, Heo SM, Shin SH, Yang JY. Trend analysis of thyroid cancer research in Korea with text mining techniques. Journal of the Korea Society of Computer and Information. 2018;23(12): 153-61. https://doi.org/10.9708/jksci.2018.23.12.153

8. Yang JY, Shin SH, Heo SM, Lee TG. A study on research topics for thyroid cancer in Korea. Paper presented at: Proceedings of the Korean Society of Computer Information Conference; 2019 January 16; Kyungwoon University Byuckkang Main Library, Gumi.

9. National Comprehensive Cancer Network (NCCN). NCCN clinical practice guidelines in oncology: thyroid carcinoma [Internet]. Pennsylvania: NCCN; 2017 [cited 2019 July 31]. Available from: https://www.nccn.org/professionals/physician_gls/default.aspx

10. Gallagher EJ, LeRoith D. Obesity and diabetes: the increased risk of cancer and cancer-related mortality. Physiological Reviews. 2015;95(3):727-48. https://doi.org/10.1152/physrev.00030.2014

11. Lee JH, Hwang Y, Song RY, Yi JW, Yu HW, Kim S, et al. Relationship between iodine levels and papillary thyroid carcinoma: a systematic review and meta-analysis. Head & Neck. 2017;39(8):1711-8. https://doi.org/10.1002/hed.24797

12. Bandurska-Stankiewicz E, Aksamit-Bialoszewska E, Rutkowska J, Stankiewicz A, Shafie D. The effect of nutritional habits and addictions on the incidence of thyroid carcinoma in the Olsztyn province of Poland. Endokrynologia Polska. 2011;62(2):145-50.

13. Lee SM, Kwak KH. Risk factors and a predictive model for thyroid cancer in Korean women. Cancer Nursing. 2010;33(4):310-9. https://doi.org/10.1097/NCC.0b013e3181cd2844

14. Kim IO, Yeom GJ, Shin SH. Factors affecting on cancer prevention behaviors in adult women. Korean Journal of Adult Nursing. 2014;26(4):455-65. https://doi.org/10.7475/kjan.2014.26.4.455

15. Torquati L, Mielke GI, Brown WJ, Kolbe-Alexander T. Shift work and the risk of cardiovascular disease. A systematic review and meta-analysis including dose-response relationship. Scandinavian Journal of Work, Environment & Health. 2018; 44(3):229-38. https://doi.org/10.5271/sjweh.3700

16. Bang SY. The relations between metabolic syndrome, physical activity, and dietary patterns in Korean adults. Journal of the Korea Academia-Industrial cooperation Society. 2019;20(2):662-72. https://doi.org/10.5762/KAIS.2019.20.2.662

17. Song H, Fang F, Arnberg FK, Mataix-Cols D, Cruz LF, Almqvist C, et al. Stress related disorders and risk of cardiovascular disease: population based, sibling controlled cohort study. British Medical Journal. 2019;365:l1255. https://doi.org/10.1136/bmj.l1255

18. Choi HS, Kang YM, Lee TY. Changes in quality of life and related factors of surgical patients with thyroid cancer. Journal of the Korea Academia-Industrial cooperation Society. 2018;19 (11):370-9. https://doi.org/10.5762/KAIS.2018.19.11.370

19. Cho SJ. Understanding of memory processing. Korea Academy of Audiology. 2012;8(1):1-8.
https://doi.org/10.21848/audiol.2012.8.1.1

20. Hur HK, Song HY. Comparison of effects of perceived stress and coping patterns on depression between cancer patients and healthy adults. Korean Journal of Hospice and Palliative Care. 2008;11(2):91-8.

21. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Research. 1989;28(2):193-213. https://doi.org/10.1016/0165-1781(89)90047-4

22. National Institute of Health. Manual of Korean genome and epidemiology study [Internet]. Cheongju: National Institute of Health; 2019 [cited 2021 April 6]. Available from:
https://www.cdc.go.kr/contents.es?mid=a40504100200

23. Lee ES. Development of the stress questionnaire for KNHANES [Internet]. Sejong: Ministry of Health and Welfare; 2010 [cited 2019 March 3]. Available from:
http://www.cdc.go.kr/board.es?mid=a40801000000&bid=0050&act=view&list_no=684

24. Jung KW, Won YJ, Oh CM, Kong HJ, Lee DH, Lee KH. Prediction of cancer incidence and mortality in Korea, 2017. Cancer Research and Treatment: Official Journal of Korean Cancer Association. 2017;49(2):306-12.
https://doi.org/10.4143/crt.2017.130

25. Stewart BW, Wild CW. World cancer report 2014 [Internet]. Geneva: International Agency for Research on Cancer; 2014 [cited 2019 July 15]. Available from:
https://www.who.int/cancer/publications/WRC_2014/en/

26. Phipps AI, Bhatti P, Neuhouser ML, Chen C, Crane TE, Kroenke CH, et al. Pre-diagnostic sleep duration and sleep quality in relation to subsequent cancer survival. Journal of Clinical Sleep Medicine. 2016;12(4):495-503.
https://doi.org/10.5664/jcsm.5674

27. Sillah A, Watson NF, Gozal D, Phipps AI. Obstructive sleep apnea severity and subsequent risk for cancer incidence. Preventive Medicine Reports. 2019;15:100886.
https://doi.org/10.1016/j.pmedr.2019.100886

28. Choi WJ, Kim J. Dietary factors and the risk of thyroid cancer: a review. Clinical Nutrition Research. 2014;3(2):75-88.
https://doi.org/10.7762/cnr.2014.3.2.75

29. Yang T, Qiao Y, Xiang S, Li W, Gan Y. Work stress and the risk of cancer: a meta-analysis of observational studies. International Journal of Cancer. 2019;144(10):2390-400.
https://doi.org/10.1002/ijc.31955

30. Han EK, Kim S, Yoon IY. Factors influencing functional health of patients with chronic insomnia based on theory of unpleasant symptoms. Korean Journal of Adult Nursing. 2019;31(2):165-75. https://doi.org/10.7475/kjan.2019.31.2.165

31. Przybylik-Mazurek E, Hubalewska-Dydejczyk A, Kuzniarz-Rymarz S, Kieć-Klimczak M, Skalniak A, Sowa-Staszczak A, et al. Dietary patterns as risk factors of differentiated thyroid carcinoma. Postępy Higieny i Medycyny Doświadczalnej (Online). 2012;66:11-5. https://doi.org/10.5604/17322693.974647

32. Tamura T, Hishida A, Wakai K. Coffee consumption and liver cancer risk in Japan: a meta-analysis of six prospective cohort studies. Nagoya Journal of Medical Science. 2019;81(1):143-50.
https://doi.org/10.18999/nagjms.81.1.143

33. Alicandro G, Tavani A, La Vecchia C. Coffee and cancer risk: a summary overview. European Journal of Cancer Prevention: The Official Journal of the European Cancer Prevention Organisation(ECP). 2017;26(5):424-32.
https://doi.org/10.1097/CEJ.0000000000000341

34. Chen X, Zhao Y, Tao Z, Wang K. Coffee consumption and risk of prostate cancer: a systematic review and meta-analysis. BMJ Open. 2021;11(2):e038902.
https://doi.org/10.1136/bmjopen-2020-038902