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## Health Behaviors Associated with Hypertension

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**Abstract:** The purpose of this study was to understand the status of health behaviors and the association of these behaviors with hypertensive elder aged 65-74 in Taiwan. Data for this study were from the 2005 National Health Interview Survey (NHIS). Health behaviors included BMI, lifestyle factors (alcohol drinking, smoking and physical activity) and dietary factors (snacks intake, sweetened beverages intake, and coffee intake). The Chi-square test was employed to examine the differences of health behavior distributions between men and women. The principal component and multiple logistic regression analysis were performed to determine the association of health behaviors with hypertension. Results showed that men have a higher percentage than women on current alcohol drinking and smoking experience. For men, current alcohol drinking was associated with age groups. Smoking experience was associated with age and BMI groups. With respect to the dietary variables, the percentage of the elder having sweetened beverages or coffee more than once per week was very low (10-15%). BMI, age, and male with smoking experience were risk factors of hypertension. The influence of BMI on hypertension was greater than other factors. Intervention program for hypertensive elders should target the overweight and obese group.

**Keywords:** health behaviors, dietary intake, hypertension

### 1. INTRODUCTION

No matter the developed or developing countries are all facing the aging problem. According to a report by the U.S. Census Bureau, the world's population aged 65 and older was about 506 million in 2008, accounting for 7% of the total. By 2040, the number of older people is projected to be 1.4 billion, 14% of the world's population<sup>[1]</sup>. Taiwan is now an aging society. At the end of 2012, the older population over 65 in Taiwan was about 2.6 million, responsible for 11.5% of the total<sup>[2]</sup>. Elder care is becoming an important public health issue. Hypertension is one of the common chronic diseases among the elderly. According to the monthly report by the Bureau of National Health Insurance (BNHI) in Taiwan, many older people have hypertension. Among the ten major causes of death, half of the causes are directly or closely related to hypertension. These causes include cerebrovascular disease, heart disease, hypertensive disease, diabetes and kidney disease. Therefore, understanding the risk factors for hypertension will help to develop appropriate public health intervention.

### 2. LITERATURE REVIEW

Essential hypertension is likely to be the consequence of an interaction between environment and genetic factors. Environmental factors are more important in the development of hypertension. Several studies have reported the prevalence of hypertension and its association with environmental factors. Redon et al. studied the impact of weight excess and fat distribution on blood pressure for individuals aged 60 and more. The results showed that the prevalence of hypertension was higher in the overweight and obesity groups<sup>[3]</sup>. Sathish et al. investigated the incidence of hypertension and its risk factors in Kerala, India. A sample of 297 individuals

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(aged 15-64 years) who were free of hypertension at study enrolment, were followed-up from 2003-2010. The results showed that nearly one-quarter (23.6%) of the sample developed hypertension. Age  $\geq$  35 years, current smoking, high-normal BP (vs. optimal BP) and central obesity were independently associated with incident hypertension<sup>[4]</sup>.

There is no general consensus on the association of gender with hypertension. Gaudemaris et al. designed a cohort study to assess the incidence of arterial hypertension in a French working population. Their studies revealed that overall prevalence was 16.1% for men and 9.4% for women. The prevalence of hypertension was significantly associated with occupational categories (OCs) and was highest among workers and lowest among upper-level executives for both genders<sup>[5]</sup>. Altobelli et al. evaluated risk factors such as socio-demographic characteristics, smoking habits and alcohol consumption associated with hypertension in psoriasis patients. Their findings revealed that the odds ratio (OR) for hypertension was higher for smokers (>15 cigarettes per day, OR=1.37, 95% CI 1.01-2.03) and drinkers (>2 glasses/day of wine, OR=2.11, 95% CI 1.31-3.40)<sup>[6]</sup>.

Geleijnse et al. studied that the impact of dietary and lifestyle factors on the prevalence of hypertension in Western societies and concluded that overweight, physical inactivity, high salt intake and low potassium intake appeared to be the major contributions<sup>[7]</sup>. Zhao et al. evaluated on the basis of specified review criteria and proposed six risk factors for hypertension including cholesterol, carbohydrates, sodium, lead, alcohol, coffee and caffeine<sup>[8]</sup>. Cohen et al. examined the association of sweetened beverages intake with incident hypertension. The results showed that higher sugar-sweetened beverages (SSBs) and artificially sweetened beverages (ASBs) intake was associated with an increased risk of developing hypertension in all three cohorts. The association between sweetened beverage intake and hypertension was stronger for carbonated beverages versus non-carbonated beverages, and for cola-containing versus non-cola beverages<sup>[9]</sup>.

This study was undertaken to compare men with women in health behaviors and identify the associated risk factors with the prevalence of hypertension among 65 to 74-year-old Taiwanese. According to literature review given above, age, gender, body mass index, smoking experience, current alcohol drinking, physical activity, snacks intake, sweetened beverages intake, and coffee intake were selected for the analysis.

### **3. MATERIALS AND METHOD**

#### **3.1 Data collection and sampling**

Data were obtained from the 2005 National Health Interview Survey (NHIS) in Taiwan. The NHIS was conducted to understand people's health status, knowledge, attitudes, behaviors and utilization of medical services. Details of the study design and sampling can be found elsewhere (Bureau of Health Promotion, 2005). In brief, the NHIS used a multistage, stratified, systematic sampling design. A total of 359 townships or districts of Taiwan were first divided into seven strata according to their geographical location and degree of urbanization. Townships or districts in each stratum were selected with a selection probability proportional to the size of the whole population, so that the whole sample drawn was nationally representative. In the survey, 2727 were 65 years and older. Incomplete and missing data were excluded and individuals aged 65-74 were 1545, of whom 762 were male and 783 were female.

#### **3.2 The study variables**

Variables analyzed in the present study included age, gender, alcohol drinking, smoking, physical activity, snacks intake, sweetened beverage intake, coffee intake, and body mass index (BMI). The alcohol drinking variable was recorded to current drinker and non-drinker. The smoking variable was dichotomized to ex-smoker and non-smoker. The physical activity variable followed a similar coding scheme: had no physical activity vs. engaged in physical activity in last 2 weeks. Snacks included two categories. One category included cookie, candy, and chocolate and the other included cake and bread. Sweetened drinks were cola, carbonated drinks, and

sweetened beverages. The items regarding dietary intake in the questionnaire were as follows: never eat (scored 0), seldom eat or less than once weekly (scored 1), eat 1-2 times weekly (scored 2), eat 3-5 times weekly (scored 3), and eat almost every day (scored 4). The total scores of 2 categories of snacks summed up to 0-8. A cut point of 2 (once per week) was used to recode the variable of snacks intake as: snacks intake  $\leq 2$  times weekly (healthy snacks intake, scored 0) and snacks intake  $>2$  times weekly (unhealthy snacks intake, scored 1). Sweetened beverage intake variable was dichotomized to healthy intake (sweetened beverage intake  $\leq 1$  time weekly, scored 0) vs. unhealthy intake (sweetened beverage intake  $>1$  time weekly, scored 1). The coffee intake variable followed the same coding scheme. BMI was used to indicate body fatness status and calculated as weight (in kg) divided by height (in m) squared ( $\text{kg}/\text{m}^2$ ). According to the definition by Bureau of Health Promotion in Taiwan, BMI was categorized as:  $\text{BMI} < 18.5$  (underweight),  $18.5 \leq \text{BMI} < 24$  (optimal weight),  $24 \leq \text{BMI} < 27$  (overweight),  $\text{BMI} \geq 27$  (obese).

### 3.3 Statistical method

Descriptive statistics were used to describe the distribution of health behaviors on age and BMI groups.  $\chi^2$  test was applied to analyze the statistical differences for lifestyle and dietary factors between age and BMI groups. Most categorical variables were also compared between hypertensive and non-hypertensive groups using  $\chi^2$  test. Because of the interrelationships among a large number of variables, the principal component analysis was conducted to derive two common underlying factors (male with smoking experience and unhealthy dietary intake). Then the factor scores were used in logistic regression to analyze the association of risk factors with hypertension.

## 4. RESULTS

Table 1 presented the comparison of men and women in lifestyle factors according to age and BMI groups. The proportion of men with current alcohol drinking and smoking experience was higher than women. Currently drinking and smoking experience for men were significantly associated with age group. The proportion of current drinker for men aged 65-69 (41%) was higher than men aged 70-74 (29.7%). In contrast, the proportion of men aged 70-74 with smoking experience (61.9%) was higher than men aged 65-69 (53.7%). Smoking experience for men was also significantly associated with BMI group. The proportion of smokers decreased with the increase in BMI. Physical activity in last two weeks was associated with BMI group for both men and women. The proportion of overweight men with physical activity was the highest (67.1%), while underweight men was the lowest group (39.3%). 60.5% of obese women with physical activity in last two weeks was the highest, while 35.1% of underweight women was the lowest.

**Table 1. Comparison of men and women in lifestyle factors according to age and BMI groups**

	Male (n=762)			Female (n=783)		
	current drinker n (%)	have smoked n (%)	did physical activity in last 2 weeks n (%)	current drinking n (%)	have smoked n (%)	did physical activity in last 2 weeks n (%)
Total	271 (35.6)	439 (57.6)	453 (59.4)	74 (9.5)	34 (4.3)	443 (56.6)
Age groups						
65~69	162 (41)	212 (53.7)	225 (56.9)	47 (10.7)	19 (4.3)	253 (57.6)
70~74	109 (29.7)	227 (61.9)	228 (62.1)	27 (7.8)	15 (4.4)	190 (55.2)
$\chi^2$	10.624 <sup>*</sup>	5.215 <sup>*</sup>	2.104	1.84	0.000	0.452
BMI groups						
<18.5	6 (21.4)	19 (67.9)	11 (39.3)	3 (8.1)	2 (5.4)	13 (35.1)

18.5~24	137 (37.6)	225 (61.8)	202 (55.5)	30 (9.0)	17 (5.1)	183 (55.1)
24~27	82 (34.6)	135 (57.0)	159 (67.1)	18 (8.2)	7 (3.2)	129 (58.9)
≥27	46 (34.6)	60 (45.1)	81 (60.9)	23 (11.8)	8 (4.1)	118 (60.5)
$\chi^2$	3.276	12.384*	12.938*	1.785	1.304	8.923*

\*  $p < 0.05$ 

Table 2 showed the comparison of men and women in dietary factors according to age and BMI groups. The proportion of study subjects having sweetened beverage or coffee more than once weekly was very low (10%-15%). No dietary factors were significantly associated with age and BMI groups. Table 3 demonstrated the comparison of men and women in hypertension according to health behaviors and age group. The prevalence of hypertension increased with increasing BMI level for both men and women. The prevalence of hypertension was related to age group in men only. Finally, we evaluated if all the variables were associated with the prevalence among 65 to 74-year-old Taiwanese. Due to the correlation among lots of variables, the principal component analysis was conducted to derive two common underlying factors. One factor was named as male with smoking experience and the other as unhealthy dietary intake. Then multiple logistic regression was used to analyze the association of age, BMI and two component factors with the prevalence of hypertension. The results showed that age, BMI, and the factor of male with smoking could be risk factors of hypertension. The OR for hypertension was higher for both age (OR=1.05, CI 1.012-1.089) and BMI (OR=1.141, CI 1.107-1.176). While the OR was lower for the factor of male with smoking experience (OR=0.859, CI 0.773-0.954).

**Table 2. Comparison of men and women in dietary factors according to age and BMI groups unit: time/week**

	Male (n=762)			Female (n=783)		
	snacks >2 times n (%)	Sweetened beverages >1 time n (%)	coffee >1 time n (%)	snacks >2 times n (%)	Sweetened beverages >1 time n (%)	coffee >1 time n (%)
Total	318 (41.7)	105 (13.8)	115 (15.1)	295 (37.7)	80 (10.2)	79 (10.1)
Age groups						
65~69	163 (41.3)	58 (14.7)	63 (15.9)	161 (36.7)	47 (10.7)	51 (11.6)
70~74	155 (42.2)	47 (12.8)	52 (14.2)	134 (39)	33 (9.6)	28 (8.1)
$\chi^2$	0.073	0.564	0.471	0.427	0.261	2.572
BMI groups						
<18.5	15 (53.6)	1 (3.6)	1 (3.6)	14 (37.8)	4 (10.8)	1 (2.7)
18.5~24	153 (42)	46 (12.6)	56 (15.4)	132 (39.8)	34 (10.2)	30 (9.0)
24~27	102 (43)	39 (16.5)	35 (14.8)	78 (35.6)	22 (10.0)	28 (12.8)
≥27	48 (36.1)	19 (14.3)	23 (17.3)	71 (36.4)	20 (10.3)	20 (10.3)
$\chi^2$	3.535	4.313	3.447	1.143	0.022	4.392

\*  $p < 0.05$ 

snacks : cookie, candy, chocolate, cake, bread

sweetened beverages : cola, carbonated drinks, sweetened beverages

**Table 3. Comparison of men and women in hypertension according to health behaviors and age group**

Male (n=762)			Female (n=783)		
Non-hypertensive n (%)	hypertensive n (%)	$\chi^2$ (p value)	Non-hypertensive n (%)	hypertensive n (%)	$\chi^2$ (p value)

Current drinking						
No	296 (60.3)	195 (39.7)	0.583 (0.445)	367 (51.8)	342 (48.2)	0.141 (0.707)
Yes	171 (63.1)	100 (36.9)		40 (54.1)	34 (45.9)	
Have smoked						
No	193 (59.8)	130 (40.2)	0.556 (0.456)	389 (51.9)	360 (48.1)	0.013 (0.909)
Yes	274 (62.4)	165 (37.6)		18 (52.9)	16 (47.1)	
Physical activity in last 2 weeks						
No	194 (62.8)	115 (37.2)	0.491 (0.483)	177 (52.1)	163 (47.9)	0.002 (0.969)
Yes	273 (60.3)	180 (39.7)		230 (51.9)	213 (48.1)	
Snacks intake (time/week)						
≤2 times	279 (62.8)	165 (37.2)	1.08 (0.299)	247 (50.6)	241 (49.4)	0.967 (0.326)
>2 times	188 (59.1)	130 (40.9)		160 (54.2)	135 (45.8)	
Sweetened beverages intake (time/week)						
≤1 time	404 (61.5)	253 (38.5)	0.085 (0.771)	371 (52.8)	332 (47.2)	1.739 (0.187)
>1 time	63 (60.0)	42 (40.0)		36 (45.0)	44 (55.0)	
Coffee intake (time/week)						
≤1 time	398 (61.5)	249 (38.5)	0.094 (0.759)	369 (52.4)	335 (47.6)	0.529 (0.467)
>1 time	69 (60.0)	46 (40.0)		38 (48.1)	41 (51.9)	
BMI						
<18.5	22 (78.6)	6 (21.4)	36.164 (0.00)*	27 (73.0)	10 (27.0)	25.376 (0.00) *
18.5~24	258 (70.9)	106 (29.1)		192 (57.8)	140 (42.2)	
24~27	123 (51.9)	114 (48.1)		113 (51.6)	106 (48.4)	
≥27	64 (48.1)	69 (51.9)		75 (38.5)	120 (61.5)	
Age						
65~69	256(64.8)	139(35.2)	4.293(0.038)	241(54.9)	198(45.1)	3.408(0.065)
70~74	211(57.5)	156(42.5)	*	166(48.3)	178(51.7)	

\*  $p < 0.05$

**Table 4 The risk factors of hypertension among 65-74-year-old Taiwanese: Analysis of multiple logistic regression**

Study subjects (n=1545)		
Factors	Odds Ratio	95% CI
age	1.050	1.012-1.089 <sup>*</sup>
BMI	1.141	1.107-1.176 <sup>*</sup>
factor 1: men with smoking experience	0.859	0.773-0.954 <sup>*</sup>
factor 2: unhealthy dietary intake	0.982	0.885-1.089

\*  $p < 0.05$

Model: hypertension = factor 1 (men with smoking experience) + factor 2 (unhealthy dietary intake) + age + BMI

## 5. DISCUSSION

In this study, we analyzed the status of health behaviors and their association with the prevalence of hypertension among 65 to 74-year-old Taiwanese. A higher proportion of men than women were current drinkers and experienced smokers. Although the proportion of current alcohol drinkers for men decreased with age, public health intervention aimed at men should be implemented to reduce alcohol and cigarette use. Smoking experience for men was associated with BMI group. There was no literature in the past to investigate

the association between men with smoking experience and BMI level. Further research should be done to clarify their association. Physical activity in last two weeks was associated with BMI group for both men and women. The proportion of overweight men or obese women doing physical activity was the highest. It is likely that 65 to 74-year-old individuals were conscious of their abnormal weight and had to do exercise to keep the weight off.

No dietary factors were significantly associated with age and BMI groups for both men and women. The proportion of study subjects having sweetened beverage or coffee more than once weekly was very low (<20%). Previous cross-sectional studies have reported an association between sugar-sweetened beverage consumption and incident hypertension. Reducing consumption of sugar-sweetened beverages can reduce blood pressure for the elder.

Three risk factors of BMI, age and male with smoking experience were significantly associated with the prevalence of hypertension. BMI made a substantial contribution to hypertension. The prevalence of hypertension increased progressively with higher levels of BMI in men and women. Age was also positively associated with the prevalence of hypertension. The findings given above were in accordance with the previous studies. However, the first component factor (male with smoking experience) was negatively correlated with the prevalence of hypertension. There was no general consensus on the association of gender with hypertension. But most studies concluded smoking was associated with the prevalence of hypertension. Narkiewicz et al. thought that smoking was a causative factor of hypertension<sup>[10]</sup>. Altobelli et al. found that psoriasis patients who smoke more than 15 cigarettes per day were at greater risk of hypertension<sup>[6]</sup>. Sathish et al. believed that current smokers (smoked in last 30 days) were at a higher risk (RR 1.99) of developing hypertension than non-smokers<sup>[4]</sup>. The variable smoking experience in this study was recorded as: never smoked (scored 0) and had smoked before (scored 1, maybe smoked a few times or smoked less/more than 100 cigarettes). From the smoking status, we could not identify if the subjects smoke everyday or have long-term smoking habit. Therefore, the result of negative association between men with smoking experience and the prevalence of hypertension in this study was not consistent with most previous studies.

This study had several limitations. First, some study subjects were proxies who may not be aware of elder health status. Second, some previous studies showed that alcohol intake (>2 glasses/day wine) and physical activity were associated with the prevalence of hypertension. However, the subjects were asked if they drink now or if they did physical activity in last two weeks in this study. The answers may not reflect the long-term drinking and exercising habits. Finally, dietary intake was measured by food intake frequency instead of servings and the question about frequency a week may result in recall bias.

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