



## A Study of a Diet Improvement Method for Controlling High Sodium Intake Based on Protective Motivation Theory

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**ABSTRACT** - High sodium dietary habits may cause various diseases, thereby threatening the public health. Various efforts have been made to control high sodium use in diets, but few studies have been conducted on health communication efforts to modify such habits. This study looks for suggestions for diet improvement education by examining whether or not high sodium dietary habits can be predicted by a consumer's perception on the threat and controllability of high sodium diets. In this study, a questionnaire was developed to measure the severity, vulnerability, efficiency, efficacy, and behavioral tendencies of the consumer, which were subscales of the protective motivation theory. The questionnaire was given to university students and their families in Chungnam Province. The results of a statistical analysis were as follows: First, more young people preferred high-sodium diets than older people. Second, the correlation analysis showed that older people knew that they were vulnerable to the negative effects of high sodium diets, but they would not change their dietary habits until they were confident that they could control the high-sodium diet. Third, the structural model analysis showed that the higher the coping perception was, the lower was the tendency to consume a high-sodium diet. These results suggest that in the effort to reduce high-sodium diets, it is more effective to provide viable information and improve efficacy.

**Key words:** Sodium intake reduction, Protective motivation theory, Health communication, Threat perception, Coping perception

Increased palatability to salty foods can lead to hypertension, stomach cancer, and osteoporosis, as people consume excess sodium<sup>1,2</sup>. In particular, Korean daily intake of sodium (2014, 3,890 mg) is high in the world and 2 times of that recommended by WHO (2,000 mg / day), which poses a serious threat to health<sup>3</sup>. The Korean Government has stated that it plans to actively promote the reduction of sodium intake<sup>4</sup>. There have been many studies on the actual state of diseases and eating habits caused by excessive sodium intake, but there have been few health communication studies dealing with how to provide health information to suppress sodium intake. A representative health communication theory is Protection Motivation Theory (PMT)<sup>5</sup>. Rogers has argued that health-related behavioral changes were made through threat perception and coping perception, and that if people were exposed to a health-threatening situation, they were motivated to protect themselves, if

people believe they could cope with the situation, they assumed that actions would be taken to protect their health. In PMT, threat perception is determined by severity and vulnerability. Severity indicates the degree of hazard in the behavior that is threatening. The vulnerability indicates how likely the threat is to actually become a reality to cause damage. And coping perception is determined by efficiency and efficacy. Efficiency indicates how efficient the action that contained in the message is and efficacy shows confidence in the ability to respond to the anticipated threat. In the meantime, PMT has been used to explain the process of change in health-related behavior, such as drinking<sup>6</sup> or drug abuse<sup>7</sup>. So, it can also give significant implications for the improvement of unhealthy dietary habits such as high sodium intake. The purpose of this study is to investigate whether PMT can be applied to predict unhealthy dietary habits such as high sodium intake and to suggest effective health communication to change these habits. According to PMT, two hypotheses can be proposed: 1) As people perceive high sodium intake as threatened, they will have behavioral tendencies to avoid it. 2) As the confidence in the ability to cope with high sodium intake increase, be-

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havioral tendencies to avoid it will increase. In terms of health care, elder people will avoid high sodium intake because they perceive high sodium intake more threatened than young people.

## Materials and Methods

### Participants and Methodology

A survey was conducted on 92 college students and their families in Chungnam Province. Among the college students and their families who were surveyed, 20s and 30s were classified as the young people, and those over 40s were classified as elder people. As a result, a total of 320 people, 152 young and 168 elder, participated in the survey. The reason why young and elder people were distinguished was because they differ in dietary habit and health concerns<sup>8)</sup>.

### Contents of the Questionnaire

For testing of whether PMT can be applied to change high sodium dietary habits, 27 items were constructed including 5 items of severity (ex, “Excessive salt intake can cause high blood pressure.”), 7 items of vulnerability (ex, “Korean eat more salt than other countries.”), 5 items of efficiency (ex, “Changing our eating habits could reduce anyone’s intake of salt.”), 5 items of efficacy (ex, “I may not eat if I feel salty.”), and 5 items of behavioral tendencies (ex, “I tend to eat my food with more salt.”). The five sub-scales used in this study referred to the questionnaire used in the study of Bang Jae-hong<sup>9)</sup> and the Likert 5-point scale<sup>10)</sup> was used, which means that the higher the score in each sub-variables, the higher the tendency. The definition and reliability of the sub-scaled used in this study are presented in Table 1.

### Analysis Method

Participants’ responses were analyzed by Statistical Package for Social Science (SPSS) 21 versions. At first, *t* test was performed to confirm whether the significant difference in behavioral tendency existed between the younger and the elderly. And correlation analysis were conducted to analyze relationships between sub factors of PMT and to examine meaningful differences between the two groups. *p* < 0.05 was regarded to be statistically significant. Finally, estimation of

**Table 2.** Means and standard deviations and standard errors of behavior tendency according to age

		N	Average	Standard Deviation	Standard Error
Age	Junior	152	3.32	0.70	0.05
	Senior	168	2.64	0.78	0.06

the fitness of the structural model based on PMT was conducted by AMOS 21.0.

## Results

### Analysis of behavioral tendency difference by age

In PMT, the most powerful sub-scales for predicting actual behavior is behavioral tendency, and the higher the number of behavioral tendency, the higher the likelihood of high sodium behavior. Before analyzing based on PMT, whether there is any difference between the young and the elderly in behavioral tendency was studied. First, the mean and standard deviation and standard error of behavioral tendency by age are presented in Table 2. The averages of behavioral tendency the young and elderly were 3.32 and 2.64, respectively.

The *t*-test was conducted to see if there was a difference in behavioral tendencies by age (*t*(318) = 8.113, *p* < 0.001). These results show that the young are higher than the elderly in behavioral tendencies that determine high sodium behavior.

### Correlation analysis of sub-scales of PMT

The correlation between sub-scales of PMT was analyzed by age. First, the correlation between sub-scales for young people is as shown in Table 3. Efficiency was correlated with efficacy, severity, and vulnerability but not with behavioral tendency. Efficacy was correlated with efficiency, severity, and vulnerability, as well as inversely with behavioral tendency. The severity was correlated with efficiency, efficacy, and vulnerability but not with behavioral tendency. Vulnerability also correlated with efficiency, efficacy, and severity, but not with behavioral tendency. Therefore, only the efficacy was the sub-scales which showed statistically significant correlation with behavioral tendency.

The results of analyzing the correlation between sub-

**Table 1.** Definitions and reliabilities of sub factors of protective motivation theory

Sub Factor	Definition	Cronbach’s $\alpha$
Severity	Indicators that reflect the degree or magnitude of the hazard of the threat	0.772
Vulnerability	A measure of the likelihood that a threat will actually be realized and damage it	0.669
Efficiency	A measure of how effective a countermeasure against a threat is	0.734
Efficacy	Indicator indicating the extent to which an individual thinks he or she can respond to a threat object	0.717
Behavior Tendency	Indicators of how voluntarily you want to behave	0.774

**Table 3.** Correlation between sub-scales of PMT (Younger Group)

	Efficiency	Efficacy	Severity	Vulnerability	Behavior Tendency
Efficiency	1	0.390**	0.409**	0.189*	0.065
Efficacy	0.390**	1	0.200*	0.247**	-0.364**
Severity	0.409**	0.200*	1	0.480**	-0.105
Vulnerability	0.189*	0.247**	0.480**	1	-0.025
Behavior Tendency	0.065	-0.364**	-0.105	-0.025	1

\*\*The correlation coefficient is at 0.01 level (both sides).

**Table 4.** Correlation between sub-scales of PMT (Elderly Group)

	Efficiency	Efficacy	Severity	Vulnerability	Behavior Tendency
Efficiency	1	0.661**	0.698**	0.462**	-0.001
Efficacy	0.661**	1	0.630**	0.365**	-0.270**
Severity	0.698**	0.630**	1	0.543**	-0.004
Vulnerability	0.462**	0.365**	0.543**	1	0.198*
Behavior Tendency	-0.001	-0.270**	-0.004	0.198*	1

\*The correlation coefficient is 0.05 level (both sides),

\*\*The correlation coefficient is at 0.01 level (both sides).

scales of PMT for elder people are presented in Table 4. In the case of the elderly, the efficiency, efficacy, and severity are similar to those of the younger generation, but the vulnerability has a little positive correlation with not only efficiency, efficacy, and severity but also behavioral tendency.

**Table 5.** Goodness of fit estimates of constructive model for PMT (Total Group)

Model	NPAR	DF	$\chi^2$	GFI	RMR	NFI	CFI	RMSEA(.073)	
								LO90	HI90
Constructive model	3	320	57.28	0.941	0.034	0.876	0.872	0.03	0.13

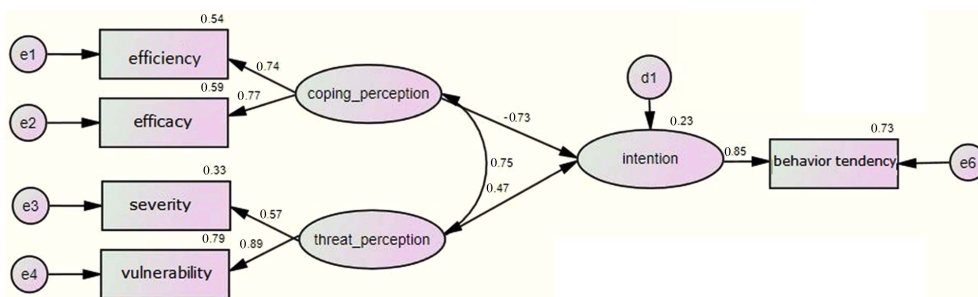
\*NPAR: Number of distinct parameter to be estimated, DF: Degree of freedom, GFI: Goodness of fit index, RMR: Root mean square residual, NFI: Normed fit index, CFI: Comparative fit index, RMSEA: Root mean square error of approximation

**Estimation of the fitness of the structural model based on PMT**

The effects of severity, vulnerability, efficiency, and efficacy on the high sodium behavior tendency were analyzed causally by AMOS path analysis. First, as shown in Table 5,  $\chi^2 (3, N = 320) = 57.28, p < 0.001$ , which is the result of the maximum likelihood method. The results show that the absolute fit of the model is good as .941 and RMR is 0.034. The relative fitness index, NFI, is 0.876, and CFI is 0.872, indicating relatively good fit. In addition, the RMSEA index, which indicates the simplicity of the model, is 0.073, but shows a range that is acceptable. Therefore, the structural model based on PMT shows that the fit index satisfies the criterion, so that the structural model well explains the observed data.

The schematic relationships between sub factors of PMT are shown in Fig. 1. The coping perception is correlated with efficiency and efficacy and the threat perception is correlated with the severity and vulnerability. Especially, attention should be paid to the relationships between coping perception, threat perception and behavioral tendency. Coping perception has a high negative correlation with intention, whereas threat perception has a positive correlation with intention.

Table 6 shows the results of analysis of regression coefficient significance among potential variables in Fig. 1. There was a statistically significant negative correlation between coping perception and intention ( $\beta = -0.72, CR = -4.00, p < 0.001$ ). Threat perception showed statistically significant correlation with intention ( $\beta = 0.46, CR = 2.58, p < 0.001$ ).



**Fig. 1.** Schematic relationships between sub factors of protective motivation theory.

**Table 6.** Parameter estimates and significant tests of latent factors

Path	Unstandardized coefficient	Standardized coefficient	SE	CR	p
Coping Perception ⇒ Intention	-1.03	-0.72	0.25	-4.00	**
Threat Perception ⇒ Intention	0.62	0.46	0.24	2.58	**

\*SE: Standard Error, CR: Composite Reliability, p: probability levels of significance

## Discussion

The purpose of this study was to investigate whether unhealthy dietary habits such as high sodium intake could be predicted by PMT and to suggest health communication method to control these unhealthy dietary habits. The results of this study were summarized as follows.

First, as a result of age-based *t*-test of behavior tendency, young people were more likely to eat high sodium diet than older adults. Second, the correlation analysis of young people showed that correlation between severity, vulnerability, and efficacy were statistically significant but behavioral tendency was negatively correlated with only efficacy. In other words, the more confident that you can suppress the high sodium diet, the less likely you will eat high sodium diet. This result appeared to be due to the fact that efficacy is the most important factor in behavior change and plays a role in activating behavior for health<sup>11)</sup>. In the correlation analysis of the elderly, the vulnerability showed a rather positive correlation with the behavior tendency. These results were inconsistent with the predictions of PMT that assumed that vulnerability would increase motivation to protect health. The positive correlation implied that those who preferred high sodium diet were more likely to know about risks of high-sodium diet and vulnerability to such risks. Third, AMOS analysis of the structural model showed that coping perception had a high correlation with efficacy and efficacy as predicted from PMT, whereas threat perception correlated with severity and vulnerability. And coping perception had a high negative correlation with intention, whereas threat perception had a positive correlation with intention. These results partly denied and partly supported the predictions based on PMT. Taking a detailed look, it was not sufficient to change high sodium dietary habits only by warning risks of high sodium diet or the vulnerability that the person might fall into danger due to high sodium diet. Therefore, high-sodium dietary habits could be changed by providing viable information for sodium intake reduction and helping people to take confidence of practicing healthy diet. However, the provision of mere information on healthy dietary may be insufficient to change unhealthy dietary habits, and a more systematic program may be needed that provides beneficial results that

can actually occur when dietary habits are changed.

## 국문요약

고염식습관은 다양한 질병을 일으키고 공중보건을 위협할 수 있다. 그 동안 고염식습관을 통제하기 위한 다양한 시도가 이루어져 왔으나 건강커뮤니케이션을 통해 고염식습관을 변화시킬 수 있는지에 대한 연구는 아직 이루어지지 못하였다. 본 연구는 고염식의위험성과 식습관의 통제가능성에 대한 인식이 고염식습관을 얼마나 예측하는지를 검토함으로써 식습관 개선 교육을 위한 시사점을 찾고자 하였다. 이러한 연구목적을 달성하기 위해 보호동기 이론의 하위요인인심각성, 취약성, 효율성, 효능 및 행동 경향을 측정하기 위한 설문지를 개발하였으며 설문지를 충남소재 대학의 대학생들과 그들의 가족을 대상으로 배포하였다. 설문결과를 SPSS프로그램으로 분석한 결과를 보면 다음과 같다. 첫째, 청년층은 장년층보다 나트륨섭취가 더 많았다. 둘째, 상관관계분석에서 장년층은 고염식으로 인한 위험에 취약하다는 것을 알고 있지만 고염식을 억제할 수 있다고 확신할 때 까지는 식습관을 바꾸지 않는다. 셋째, 구조모델분석에 따르면 대처지각이 높을수록 고염식습관의 경향성이 낮아지는 경향을 보인다. 이 결과는 고염식습관을 줄이기 위해서는 실행 가능한 정보를 제공하고 저염식을 하였을 때 어떤 변화가 발생하는지를 인식 시킴으로써 대처지각을 높이는 방안이 더 효과적임을 시사한다.

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