

# Structural relations of late night snacking choice attributes and health promotion behaviors according to dietary style of industrial workers

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**BACKGROUND/OBJECTIVES:** This research was conducted to develop a construct model regarding the dietary style, late night snacking choice attributes and health promotion behaviors of industrial workers.

**SUBJECTS/METHODS:** The surveys were collected during the period between January and February 2013. A statistical analysis of 888 industrial workers was conducted using SPSS 12.0 for Windows and SEM (Structural Equation Model) using AMOS (Analysis of Moment Structure) 5.0 statistics package.

**RESULTS:** The results of the correlations between all variables showed significant positive correlations ( $P < 0.05$ ). Results of factors analysis on dietary styles were categorized into five factors and health promotion behaviors were categorized into four. The reliability of these findings was supported by a Cronbach's alpha coefficient of 0.6 and higher for all other factors. After obtaining the factors from processing an exploratory factor analysis and the end results supported the validity. In an attempt to study the late night snacking choice attributes in accordance to dietary styles and the health promotion behaviors of industrial workers, a structural equation model was constructed and analyzed.

**CONCLUSIONS:** All tests proved the model satisfied the recommended levels of the goodness of fit index, and thus, the overall research model was proved to be appropriate.

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**Keywords:** Industrial workers, dietary style, late night snacking choice attributes, health promotion behaviors, SEM (Structural Equation Model)

## INTRODUCTION

As the industrial sector increases, a growing number of workers are coping with lifestyle changes and occupation-related accidents and diseases [1]. Concurrently, with the increase of industrialization, the health profile of the country is also changing. Presently, metabolic syndromes such as cardiovascular diseases and type2 diabetes have become the leading causes of morbidity and mortality in Korea. Both of these conditions are linked to unhealthy consumption behaviors and physical inactivity [2].

To prevent or manage metabolic syndrome, it has been suggested that we need to understand lifestyle-associated risk factors, and then modify them. Several lifestyle factors including a smoking, alcohol consumptions, exercising, and eating habits have been found to influence metabolic syndrome abnormalities [3-7]. Up until today, many studies have reported associations between dietary patterns and metabolic syndromes [8-11]. Dietary pattern approaches are beneficial as they capture the complex nature of dietary intakes and explore its relationship with health outcomes.

The notion that late evening meals promote weight gains is popular, and many diets recommend limiting food intakes

during the late night hours [12] because metabolic rate decreases during sleep [13]. Late evening meals may also elicit postprandial hyperglycemia, since glucose tolerance decreases from morning to midnight [14].

Health promotion can be regarded as a combination of educational, organizational, economic and political actions designed with consumer participation, to enable individuals, groups and whole communities to increase control over, and to improve their health through attitudinal, behavioral, social and environmental changes, as stressed by the World Health Organization [15,16]. As individuals live longer, health promotion behaviors become even more important, particularly with regards to maintaining function and independence, and improving quality of life [17-19]. Since the National Health Promotion Act was enacted in [20], there has been a growing need for developing community-focused health promotion programs that are directed towards the population in Korea.

Therefore, this study examined the degree of health promotion behaviors and the relationship between dietary styles, late night snacking choice attributes and health promotion behaviors among the Korean industrial workers who live within the community. This study elucidated the health promotion behaviors that Korean industrial workers are engaged in, how they

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evaluate their dietary styles, and whether their dietary style varies by the degree of health promotion behaviors.

## SUBJECTS AND METHODS

### Study participants

Survey questionnaires were directly distributed to the industrial workers in Kyungsangnamdo. The data were collected from 888 industrial workers from January to February 2013, and approximately 30 to 40 minutes was used per person.

Survey protocols, instruments and the process for obtaining informed consent for this study were approved by the institutional review committees of Sookmyung Women's University (Approval No. 13-0923-007). All participants gave their written informed consent.

### Questionnaire

The questionnaire for industrial workers' dietary style was constructed with reference to relevant previous studies [21-23] and consisted of 17 items on eating habits and the questionnaire for late night snacking choice attributes was constructed with reference to relevant previous studies [12-14] and consisted of 5 items on quality, price, sanitation, quantity and nutrition. The questionnaire for industrial workers' health promotion behavior was constructed with reference to relevant previous studies [24-27] and consisted of 16 items on exercise management, personal relationship, self-realization and nutrition management. The 5-point Likert scale was utilized to evaluate the items, and selecting 1 point means 'strongly disagree' while 5 points refers to 'strongly agree.'

### Research model and hypotheses

Independent variables were dietary life where late night snacking choice attributes was introduced as a parameter and the dependent variable of health promotion behavior. The following hypotheses were set up based on the assumption that the variables of this model were closely related.

Hypothesis 1: The dietary style of industrial workers will significantly affect late night snacking choice attributes.

Hypothesis 2: The late night snacking choice attributes of industrial workers will significantly affect health promotion behavior.

Hypothesis 3: The dietary style of industrial workers will significantly affect health promotion behavior.

### Statistical analysis

The data were analyzed by SPSS 12.0 for Window and SEM which was created by AMOS 5.0 packages. Firstly, the reliability was deduced by an exploratory factor analysis and a Cronbach's alpha coefficient, and then, the validity was established by a confirmatory factor analysis. Secondly, a correlation analysis was performed for each factor. Thirdly, the SEM was utilized to identify a path coefficient for the current study model on the basis of reliability and validity results.

## RESULTS

### Participants

According to the demographic analysis, frequency of late night snacking and general health status of the industrial workers in Table 1 and Table 2, 70.30% of the industrial workers were aged 30-49, 61.40% had completed education of high school. Most of them (67.60%) were married and 31.40% of them were still single. The largest percentage (42.80%) of industrial workers had late-night snacks twice or three times a week, and 22.30% of them took late-night meals. Nearly half of the workers (58.90%) were in normal health, and 18.90% was either unhealthy or very unhealthy.

### Exploratory factor analysis of questionnaire item of industrial worker's dietary style

The results of the dietary life 17 items as determined by the exploratory factor analysis are presented in Table 3. Dietary styles were categorized into five factors such as trend-oriented,

**Table 1.** Demographic characteristics of the questionnaire from respondents (N = 888)

	Category	N	%
Gender	Male	742	83.60
	Female	146	16.40
Age(yrs)	20-29	174	19.60
	30-39	325	36.60
	40-49	299	33.70
	≥ 50	90	10.10
	Education	Under middle school	11
	Middle school	45	5.10
	High school	545	61.40
	University	276	31.10
	Over university graduate	11	1.20
Marital status	Married	600	67.60
	Single	279	31.40
	etc	9	1.00
Household income (10,000 won/month)	≤ 100	8	9.26
	100-199	203	23.46
	200-299	366	18.52
	300-399	160	26.54
	≥ 400	151	8.64

**Table 2.** Frequency of late night snacking and general health status of the questionnaire from respondents (N = 888)

	Category	N	%
Frequency of late night snacking	Eat little	140	15.80
	1/week	125	14.10
	2-3/week	380	42.80
	4-5/week	198	22.30
	6-7/week	45	5.10
General health status	Very healthy	18	2.00
	Healthy	179	20.20
	Average	523	58.90
	Unhealthy	152	17.10
	Very unhealthy	16	1.80

**Table 3.** Explorative factor analysis on dietary style of industrial workers

	Question	Factor1	Factor2	Factor3	Factor4	Factor5	Cronbach's alpha
Trend-oriented	Easily follow the latest trend of foods	0.847					0.836
	Try to have a variety of foods	0.810					
	Enjoy eating trendy foods	0.774					
	Know famous restaurants and foods	0.719					
Economy-oriented	Always check the price when buying groceries		0.830				0.802
	First consider discount products when buying groceries		0.811				
	Buy groceries after comparing price		0.762				
	Buy cheaper product when quality is similar		0.743				
Health-oriented	First consider food additives when buying groceries			0.866			0.750
	Always buy organic foods			0.842			
	Carefully choose food for health			0.680			
Convenience-oriented	Eat delivery food often				0.828		0.759
	Often purchase the ready-to-eat food				0.804		
	Eat fast food often				0.778		
Gourmet-oriented	Consider nutrition than taste when purchase food					0.807	0.716
	Not fear of new flavors					0.747	
	However much it costs, purchase if it looks tasty					0.720	
	Explained variance	2.706	2.572	2.131	2.084	1.908	
	Explained rate (%)	15.902	15.130	12.536	12.261	11.221	
	Cumulative percentage	15.920	31.050	43.586	55.847	67.068	

**Table 4.** Explorative factor analysis of late night snacking choice attributes

Question	Factor	Cronbach's alpha
Quality	0.780	
Price	0.776	
Sanitation	0.756	0.809
Quantity	0.741	
Nutrition	0.713	
Explained variance	2.839	
Explained rate (%)	56.775	

economy-oriented, health-oriented, convenience-oriented and gourmet-oriented. The reliability of these findings was supported by a Cronbach's alpha coefficient of 0.836, 0.802, 0.750, 0.759 and 0.716, respectively. The validity was established by 67.068% of the explained rate for the factors of dietary style.

#### Exploratory factor analysis of questionnaire item of industrial worker's late night snaking choice attributes

The results of the daily activities items as determined by the exploratory factor analysis are presented in Table 4. The items include 'Quality', 'Price', 'Sanitation', 'Quantity' and 'Nutrition'. Reliability and validity were established by 0.809 of Cronbach's alpha, and 56.775% of the explained rate for the factors on the late night snacking choices.

#### Exploratory factor analysis of questionnaire item of industrial worker's health promotion behavior

Table 5 displays the results of the health promotion behavior on 16 items as indicated by the exploratory factor analysis. Four factors in total were identified as a result of the first factor analysis, but a low Cronbach's alpha coefficient was found from the factor including items. Therefore, the second factor analysis was conducted after the items were excluded. As a result, four

factors were identified and revealed 63.442% of the explained rate, and the respective Cronbach's alpha reliability coefficients for the factors 1, 2, 3 and 4 were reported as 0.901, 0.777, 0.756 and 0.602.

#### Correlation analysis for the variables

The results, as shown in Table 6, indicate that multicollinearity was not a problem among all variables since the highest correlation coefficient was -1.932. There were significant correlations between all the variables. The most correlated variables were expected for health-oriented and convenience-oriented ( $r = -1.932, P < 0.01$ ), and trend-oriented and gourmet-oriented were next ( $r = 0.484, P < 0.01$ ), which were followed by expectations on exercise management and self-realization ( $r = 0.428, P < 0.01$ ) according to relationship and self-realization ( $r = 0.373, P < 0.01$ ). The least correlated variables were health-oriented and personal relationship ( $r = 0.003$ ).

#### Confirmatory factor analysis of the measurement model

As shown in Table 7, by the confirmatory factor analysis of the measurement model, Construct Reliability (CR) and Average Variance Extracted (AVE) are 0.7 or more and 0.5 or more respectively, which sufficiently supports the reliability of latent variables and constructs validity. The model was also confirmed as appropriate since the optimal results revealed the values of  $\chi^2 = 1,891.755$ , GFI = 0.892, AGFI = 0.872, IFI = 0.902, NFI = 0.860, CFI = 0.901, RMR = 0.047, and RMSEA = 0.050, which satisfied the recommended standards, and also proved the model to be appropriate.

#### Model fit test of the measurement model

Table 8 reports the results of hypothetical model fit indices as  $\chi^2 = 1,713.843$ , GFI = 0.904, AGFI = 0.885, IFI = 0.915, NFI =

**Table 5.** Explorative factor analysis of health promotion behaviors of industrial workers

	Question	Factor1	Factor2	Factor3	Factor4	Cronbach's alpha
Exercise management	Moderate exercise considering body conditions	0.873				0.901
	Proper amount of exercising for health promotion	0.833				
	Taking regular exercises	0.813				
	Participates in exercise programs	0.813				
	Exercise in everyday life (ex: take stairs instead of elevators)	0.763				
Personal relationship	Have a heart-to-heart session with friends or colleagues		0.811			0.777
	Retain confidence with other people		0.768			
	Meet up with plenty of friends or colleagues		0.731			
	Maintain comfortable relationships with acquaintances		0.702			
Self -realization	Grasp stressor and aggressively act			0.774		0.756
	Take regular breaks everyday			0.743		
	Have own ways of coping with the stress			0.678		
	Be contented with present life			0.674		
Nutrition management	Try to avoid junk food				0.837	0.602
	Have not overconsumed due to weight controls				0.720	
	Eat regular meals				0.613	
	Explained variance	3.576	2.485	2.339	1.751	
	Explained rate (%)	22.347	15.532	14.621	10.941	
	Cumulative percentage	22.347	37.879	52.500	63.442	

**Table 6.** Correlation analysis for variables of industrial workers

Variables <sup>1)</sup>	A	B	C	D	E	F	G	H	I	J
A	1.0000									
B	0.127**	1.0000								
C	0.158**	0.095**	1.0000							
D	0.209**	-0.012-	-1.932**	1.0000						
E	0.484**	-0.089**	0.153**	0.193**	1.0000					
F	0.254**	0.106**	0.192**	0.110**	0.131**	1.0000				
G	0.076**	0.009	0.277**	-0.055	0.084*	0.006	1.0000			
H	0.268**	0.150**	0.003	-0.008	0.155**	0.042	0.212**	1.0000		
I	0.191**	0.075*	0.233**	-0.086*	0.212**	0.095**	0.428**	0.373**	1.0000	
J	0.95**	0.120**	0.347**	-0.263**	0.066	0.069*	0.343**	0.212**	0.328**	1.0000

<sup>1)</sup> A: Trend oriented, B: Economy oriented, C: Health oriented, D: Convenience oriented, E: Gourmet oriented, F: Late night snacking choice attributes, G: Exercise management, H: Personal relationship, I: Self-realization, J: Nutrition management  
 \*  $P < 0,05$ , \*\*  $P < 0,01$ , \*\*\*  $P < 0,001$ .

**Table 7.** Goodness of fit in confirmatory factor analysis of industrial workers

Model	$\chi^2$ <sup>1)</sup> (P-value)	$\chi^2/df$ <sup>2)</sup>	GFI <sup>3)</sup>	AGFI <sup>4)</sup>	IFI <sup>5)</sup>	NFI <sup>6)</sup>	CFI <sup>7)</sup>	RMR <sup>8)</sup>	RMSEA <sup>9)</sup>
Optimum model	$P > (.05)$	$< 2$	.90-1	.90-1	.90-1	.90-1	.90-1	$< 0.05$	$< 0.5$
Hypothetical model	1,891.755 (.000)	3.037	0.892	0.872	0.902	0.860	0.901	0.047	0.050

<sup>1)</sup>  $\chi^2$ : Chi-square, <sup>2)</sup>  $\chi^2/df$ : Chi-square divided by degree of freedom,  
<sup>3)</sup> GFI: Goodness of fit index, <sup>4)</sup> AGFI: Adjusted goodness of fit index,  
<sup>5)</sup> IFI: Incremental fit index, <sup>6)</sup> NFI: Normed fit index,  
<sup>7)</sup> CFI: Comparative fit index, <sup>8)</sup> RMR: Root mean residual,  
<sup>9)</sup> RMSEA: Root means squared error of approximation.

**Table 8.** Hypothetical model fit index of industrial workers

Model	$\chi^2$ <sup>1)</sup> (P-value)	$\chi^2/df$ <sup>2)</sup>	GFI <sup>3)</sup>	AGIF <sup>4)</sup>	IFI <sup>5)</sup>	NFI <sup>6)</sup>	CFI <sup>7)</sup>	RMR <sup>8)</sup>	RMSEA <sup>9)</sup>
Goodness of fit criteria	$P > (.05)$	$< 2$	.90-1	.90-1	.90-1	.90-1	.90-1	$< 0.05$	$< 0.5$
Hypothetical model	1,713.843 (.000)	2.769	0.904	0.885	0.915	0.873	0.915	0.039	0.045
Result	unfit	acceptable	fit	acceptable	fit	acceptable	fit	fit	fit

<sup>1)</sup>  $\chi^2$ : Chi-square, <sup>2)</sup>  $\chi^2/df$ : Chi-square divided by degree of freedom,  
<sup>3)</sup> GFI: Goodness of fit index, <sup>4)</sup> AGFI: Adjusted goodness of fit index,  
<sup>5)</sup> IFI: Incremental fit index, <sup>6)</sup> NFI: Normed fit index,  
<sup>7)</sup> CFI: Comparative fit index, <sup>8)</sup> RMR: Root mean residual,  
<sup>9)</sup> RMSEA: Root means squared error of approximation.

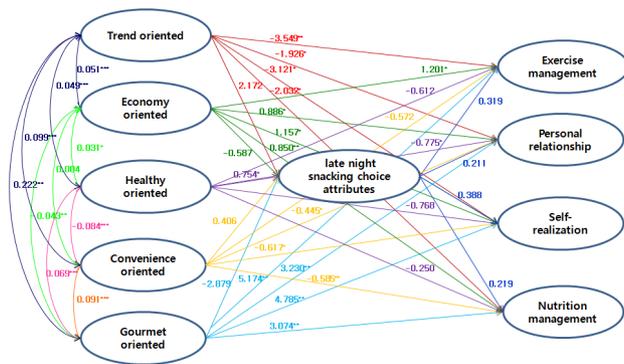


Fig. 1. Final results of the model analysis using AMOS.

0.873, CFI = 0.915, RMR = 0.039, and RMSEA = 0.045. Although the  $\chi^2$  value was revealed to be inappropriate, the current research model in Fig. 1 was confirmed to be appropriate since the other indices like GFI, IFI, CFI, RMR and RMSEA were proved to be appropriate, and CMIN/DF, AGFI and NFI satisfied the recommended standards.

As a result of testing Hypothesis 1, while health-oriented was adopted, it turned out to have significant positive (+) effects on the late night snacking choice attributes; the taste-oriented, convenience-oriented, economy-oriented, and trend-oriented were all rejected because they had no significant effects. As a result of testing Hypothesis 2, it turned out that although the late night snacking choice attributes had positive (+) effects on the health promotion behaviors, it was not significant, and thereby Hypothesis 2 was rejected. As a result of testing Hypothesis 3, the trend-oriented had significant negative (-) effects on all the health promotion behaviors.

**DISCUSSION**

This research analyzes the industrial workers' dietary styles for the intakes of late night snacks and the choice attributes being brought to the consumers. It further attempts to draw a relationship between late night snacking choice attributes and the effects it has on health promotion behaviors by using the method of construct model development. The audience for the surveys was industrial workers, and they were sampled during the period between January and February 2013.

Factor analysis was applied to: 17 questions related to dietary styles, 5 questions were related to late night snacking choice attributes and 16 questions related to health promotion behavior. Questions in industrial workers' dietary style category was summed up under 5 factors, late night snacking choice attribute into 1 factor, and health promotion behavior was summed up as 4 factors. As a result on the exploratory factor analysis, the Cronbach's alpha was 0.6 or more for all factors, which established the reliability. The results of the correlations revealed that multicollinearity was not a problem among all variables since the highest correlation coefficient was 0.484, and that the significant positive correlations between variables have emerged. After factors were identified by the exploratory factor analysis, the confirmatory factor analysis of the measurement model was performed with AMOS to establish the validity. As

a result, the  $\chi^2$  value was revealed to be inappropriate, but the other indices except for these two values were proven to be appropriate enough to satisfy the recommended level.

As a result of testing Hypothesis 1, while health-oriented was adopted, it turned out to have significant positive (+) effects on the late night snacking choice attributes. According to a study of Seo [28], the number of midnight snack intakes for workers significantly influenced bedtime and wakeup conditions, and Kim [29] reported that the obesity managing type ingests little midnight snacks as comparing to the potential obesity and habitual obesity types. Thus, it is considered that workers who try stay healthy select midnight snacks after considering its quality, nutrition, amount, price, etc.

As a result of testing Hypothesis 2, it turned out that although the late night snacking choice attributes had positive (+) effects on the health promotion behaviors, it was not significant, and thereby Hypothesis 2 was rejected.

As a result of testing Hypothesis 3, the trend-oriented had significant negative (-) effects on all the health promotion behaviors. According to a study by Moon [23], the trend-oriented had a relatively higher ostentation than others. Thus, workers who seek such trends are recognized to be more interested in health promotion programs in vogue due to ostentation than in health promotion behaviors. The economy-oriented had significant positive (+) effects on all the health promotion behaviors, which is similar to a research by Han & Ha [30] that deduced female consumers with a higher economic level tend to have a higher degree of behaviors on weight controls. While the health-oriented had a significant effect on personal relationships (-0.775), it had insignificant negative (-) effects on self-realization, exercise management, and nutrition management. Hence, results of this study indicate that workers who sought dietary lives and considered health, had a low degree of health promotion behaviors; this coincided with that of Lee & Lee [31] where industrial workers consumed alcohol more frequently and had higher fatigues, they also showed a higher degree of health promotion behaviors. It turned out that while the convenience-oriented had significant negative (-) effects on personal relationship (-0.445), self-realization (-0.617), and nutrition management (-0.585), it had insignificant negative (-) effect on the exercise management. A research of Kim [32] & Kim [33] targeting nurse practitioners indicated that higher fatigues led to lower degrees of health promotion behaviors. Thus, it is concluded that convenience-oriented workers who preferred cooked foods and convenient fast foods are more sensitive to physical and mental fatigues, and thereby, show negative (-) tendencies towards health promotion behaviors. The gourmet-oriented turned out to have significant effects on exercise management (5.17), personal relationship (3.230), self-realization (4.785), and nutrition management (3.704), which indicates that it had significant positive (+) effects on all the health promotion behaviors. According to a study by Kim [33], the quality of life on the gourmet-oriented turned out to be high. Thus, high quality life meant high satisfaction level for life and highly subjective of well-being [34-36], it is known that workers who prefer delicious foods have lots of positive emotional experiences, and thereby, are active when promoting the health behaviors.

This study classified dietary life types of industrial workers and grasped their effects on the late night snacking choice attributes and the health promotion behaviors. Health promotion programs that fit for each dietary life type need to be developed based on this study, and health of industrial workers should be improved through appropriate health management programs; and eventually, national health policies need to be economically established and competitiveness of industries and the nation should be raised by lowering the morbidity rate of chronic diseases.

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