

# The Effects of industrial workers' food choice attribute on sugar intake pattern and job satisfaction with Structural Equation Model

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**BACKGROUND/OBJECTIVES:** This research analyzes the effects of the food choices of industrial workers according to their sugar intake pattern on their job satisfaction through the construction of a model on the relationship between sugar intake pattern and job satisfaction.

**SUBJECTS/METHODS:** Surveys were collected from May to July 2015. A statistical analysis of the 775 surveys from Kyungsangnam-do was conducted using SPSS13.0 for Windows and SEM was performed using the AMOS 5.0 statistics package.

**RESULTS:** The reliability of the data was confirmed by an exploratory factor analysis through a Cronbach's alpha coefficient, and the measurement model was proven to be appropriate by a confirmatory factor analysis in conjunction with AMOS. The results of factor analysis on food choice, sugar intake pattern and job satisfaction were categorized into five categories. The reliability of these findings was supported by a Cronbach's alpha coefficient of 0.6 and higher for all factors except confection (0.516) and dairy products (0.570). The multicollinearity results did not indicate a problem between the variables since the highest correlation coefficient was 0.494 ( $P < 0.01$ ). In an attempt to study the sugar intake pattern in accordance with the food choices and job satisfaction of industrial workers, a structural equation model was constructed and analyzed.

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

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## INTRODUCTION

People's eating habits have a decisive effect on their health [1]. Food choice is a seemingly simple but actually very crowded behavior influenced by many interacting factors [2]. The mood is used most often in customer and marketing service research examining store atmospherics [1]. Environmental factors of people, time of consumption, smell, colors, or physical setting might influence food intake and food choice, resulting in a lack of appropriate adaptations in intake [3,4]. Knowledge of consumer behavior was soon asserted by marketing sections who, being trained in general marketing techniques, usually had very little knowledge about the sensory and nutritional aspects of the products they were dealing with and little insight into the very special nature of eating behavior [2].

Sugar now accounts for an unprecedented proportion of the human diet. A study has preliminarily probed the hypothesis that sugar consumption may impact the prevalence of major depression by correlating the per capita consumption of sugar with the prevalence of major depression [5]. Generally speaking, 'sugar' signify simple sugars and the consumption of food with a lot of simple sugars causes an individual to consume less of other foods that are high in diverse nutrients, leading to a

nutritional imbalance [6]. It could also lead to obesity as the calories got from sugar can accumulate easily as body fat [6]. The use of favorite foods is however recently increasing and the intake of sugar is showing an continual increase because of the westernization of dietary life [7]. The sugar intake of Koreans in 2010 was 61.4 g, an growth of 23% from 49.9 g in 2008. Especially, sugar intake from processed food grew by 41% from 19.3 g in 2008 to 27.3 g in 2010. This trend was indicated across all ages, leading to concerns about young children developing adult diseases [8]. The Korean government has set up a nationwide food safety system with strict control of hazardous nutrients like sugar, fatty acids and sodium as well as an advanced nutrition education system [9]. Previously, it was reported that as the level of stress experienced by students increased, the more frequently they consumed sugar such as candy, chocolate, pastry and beverages [10]. Therefore, this study aims at finding the relationship between job satisfaction and sugar intake pattern for industrial workers.

Job satisfaction is a positive emotional state resulting from the valuation of one's work and experience. Job satisfaction is an essential part of the organizational climate and an important element in the management-employee relationship. It is the positive emotional state that appears when a person's job

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seems to achieve important job values, provided these values are harmonious with one's needs [11]. The effects of workplace stress on employees' health is associated with negative organizational outcomes such as job dissatisfaction, burnout, and absenteeism [12-14].

There are many existing studies that have researched food intake for different age groups, but many of them were focused on children. Thus, the present study intends to provide basic data to improve job satisfaction by determining the sugar intake pattern and explicating its relationship with job satisfaction through analyzing the food choices of industrial workers.

## SUBJECTS AND METHOD

### Subjects

This study conducted a survey of 1,050 male and female industrial workers (White & blue collar) in Kyungsangnam-do from May to July 2015. 775 workers were selected as the subjects of analysis, and each participant spent approximately 30 to 40 minutes on the survey. 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 (SMWU-1504-HR-006). All participants gave their written informed consent.

### Questionnaire

For the general status of the target sample, we investigated gender, age and general health status of workers. And the questionnaire for Food choice attributes was constructed with reference to relevant previous studies [15-19] and consisted of 22 items on Sugar intake [7,10,19] from fruits, snacks, beverages, confections and dairy products. The questionnaire for industrial workers' job satisfaction was composed with reference to related previous studies [20-22] and consisted of 22 items on work, pay, performance, people, and environment satisfaction, measured using a 5-point Likert scale.

### Research hypotheses

A structural equation model was used to examine the effect of industrial workers' food choices on their sugar intake pattern and job satisfaction.

Hypothesis 1. Food choice attribute will be significantly different depending on the sugar intake pattern.

Hypothesis 2. Sugar intake pattern will be significantly different depending on the job satisfaction.

Hypothesis 3. Food choice attribute will be significantly different depending on the job satisfaction.

### Statistical analysis

All of the collected data were analyzed with SPSS 13.0 for Windows and AMOS (Analysis of Moment Structure) 5.0 Statistical programs. In order to test the unidimensionality of multiple items that comprised each factor, exploratory factor analysis and reliability tests were performed. After evaluating the validity of the measured items by performing confirmatory factor analysis for each factor, Structural Equation Modeling (SEM) was used to determine the path coefficients of the research model.

## RESULTS

### General characteristics

As shown in Table 1, 638 (82.3%) industrial workers were male and 535 (69.0%) were aged 30-49. The majority (52.9%) of industrial workers was in normal health, and 39.0% of them were either unhealthy or very unhealthy.

### Exploratory factor analysis on measurement models

#### Food choice attribute

According to the results of exploratory factor analysis (EFA) on Food choice attribute items, 5 factors were extracted (Table 2). The explanatory power was 71.582%, and the Cronbach's alpha coefficients showed a reliability of 0.811, 0.903, 0.853, 0.814 and 0.660. Factor 1 was named 'Health', factor 2 'Mood', factor 3 'Convenience', factor 4 'Sensory appeal', and factor 5 'Price'.

#### Sugar intake pattern

The results for the 16 items under the sugar intake pattern as determined by the exploratory factor analysis are presented in Table 3. Sugar intake pattern was categorized into the five factors 'Fruit', 'Snack', 'Beverage', 'Confection' and 'Dairy product'. The reliability of these findings was supported by Cronbach's alpha coefficients of 0.851, 0.705, 0.744, 0.516, and 0.570, respectively. The validity was established by an explanatory power of 64.207% for the dietary factors.

#### Job satisfaction

Table 4 displays the results of the 18 items under health promotion behavior as indicated by the exploratory factor analysis. Five 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, a second factor analysis was conducted after the items were excluded. Five factors were subsequently identified and explained 69.424% of the results. The respective Cronbach's alpha reliability coefficients for factors 1, 2, 3, 4 and 5 were reported as 0.878, 0.860, 0.794, 0.728, 0.792 and 0.787. Factor 1 was named 'Work', factor 2 'Pay', factor 3 'Performance', factor 4 'People', and factor 5 'Environment'.

**Table 1.** Demographic characteristics of the respondents (N = 775)

Category		N	%
Gender	Male	638	82.30
	Female	137	17.70
Age(yrs)	20-29	159	20.50
	30-39	334	43.10
	40-49	201	25.90
	≥ 50	81	10.50
	Very healthy	21	2.70
General health status	Healthy	155	20.00
	Average	402	51.90
	Unhealthy	167	21.50
	Very unhealthy	30	3.90

**Table 2.** Explorative factor analysis on food choice attributes of industrial workers

Factor name	Question	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Cronbach's alpha
Health	Is nutritious	0.764					0.811
	Contains natural ingredients	0.886					
	Contains no additives	0.843					
Mood	Cheers me up		0.893				0.903
	Helps me to cope with life		0.858				
	Makes me feel good		0.856				
	Helps me relax		0.844				
Convenience	Can be cooked very simply			0.905			0.853
	Is easy to prepare			0.855			
	Can be bought in shops close to where I live or work			0.812			
Sensory appeal	Has a pleasant texture				0.830		0.814
	Looks nice				0.829		
	Smells nice				0.786		
	Tastes good				0.668		
Price	Is not expensive					0.823	0.660
	Is cheap					0.740	
	Is good value for the money					0.694	
Eigen-value		2.226	3.134	2.626	2.343	1.840	
Explained rate (%)		13.095	18.438	15.446	13.780	10.823	
Cumulative percentage		13.095	31.533	46.979	60.759	71.582	

**Table 3.** Explorative factor analysis on sugar intake pattern of industrial workers

Factor name	Question	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Cronbach's alpha
Fruit	Pear	0.867					0.851
	Persimmon	0.843					
	Grape	0.822					
	Tangerine	0.688					
Snack	Sweet and sour pork		0.775				0.705
	Jabchae		0.691				
	Tteok-bokki		0.671				
	Pizza		0.622				
Beverage	Soda			0.821			0.744
	Beverages			0.797			
	Juice or fruit-flavored			0.782			
Confection	Chocolate				0.796		0.516
	Caramel				0.669		
	Candies				0.651		
Dairy product	Yogurt eaten with a spoon					0.789	0.570
	Drinking yogurt					0.775	
Eigen-value		2.873	2.206	2.042	1.673	1.480	
Explained rate (%)		17.955	13.785	12.760	10.457	9.250	
Cumulative percentage		17.955	31.739	44.500	54.957	64.207	

### Correlation analysis for the variables

The results, as shown in Table 5, indicate that multicollinearity was not a problem with most variables since the highest correlation coefficient was 0.494. The highest expected correlation was between 'Pay' and 'Performance' ( $r = 0.494$ ,  $P < 0.01$ ), followed 'Fruit' and 'Snack' ( $r = 0.417$ ,  $P < 0.01$ ), 'People' and 'Environment' ( $r = 0.382$ ,  $P < 0.01$ ) and 'Pay' and 'People' ( $r = 0.378$ ,  $P < 0.01$ ).

### Confirmatory factor analysis on the measurement model

The results of confirmatory factor analysis on the measurement model are shown in Table 6. The Goodness-of-fit index results for the model are shown in Table 6 along with the recommended level for each index. The model was also confirmed as appropriate since the optimal results revealed the values of  $\chi^2 = 2423.627$ , GFI = 0.886, AGFI = 0.865, IFI = 0.921, NFI = 0.862, CFI = 0.920, RMR = 0.054, and RMSEA = 0.039, which satisfied the recommended standards, and also proved the model to be appropriate.

**Table 4.** Explorative factor analysis of job satisfaction of industrial workers

Factor name	Question	Factor1	Factor2	Factor3	Factor4	Factor5	Cronbach's alpha
Work	I like doing the things I do at work	0.863					0.878
	My job is enjoyable	0.854					
	I feel a sense of pride in doing my job	0.794					
	I enjoy my work more than others	0.784					
Pay	I receive high wages compared to others doing the same job		0.844				0.860
	Wage determination process is fair		0.849				
	I feel satisfied with my chances for salary increases		0.757				
	I feel I am being paid a suitable amount for the work I do		0.749				
Performance	There are sufficient opportunities for training relevant to operations			0.837			0.728
	I have opportunities to learn what I want to learn			0.784			
	Personnel evaluation is relatively fair			0.594			
People	My supervisor is fair to me				0.805		0.792
	Communications seem good within this organization				0.797		
	The supervisor encourages employees when a problem arises				0.718		
	I enjoy my coworkers				0.685		
Environment	The labor force maintains suitable business conduct in the office					0.842	0.787
	There is a fresh, novel atmosphere about the place					0.831	
	I am satisfied with the office environment					0.693	
Eigen-value		2.989	2.924	1.915	2.526	2.142	
Explained rate (%)		16.607	16.244	10.640	14.033	11.900	
Cumulative percentage		16.607	32.851	43.491	57.524	69.424	

**Table 5.** Correlation analysis for variables

Variables <sup>1)</sup>	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	1														
B	0.272**	1													
C	-0.151**	0.046	1												
D	0.065	0.282**	0.265**	1											
E	0.050	0.133**	0.235**	0.258**	1										
F	0.098**	-0.029	-0.071*	-0.027	-0.039	1									
G	-0.002	-0.040	-0.029	-0.072*	-0.040	0.417**	1								
H	0.020	0.006	0.059	0.035	0.048	0.223**	0.288**	1							
I	-0.085*	0.035	0.034	0.051	0.007	0.318**	0.329**	0.179**	1						
J	0.022	0.055	-0.091*	-0.025	-0.055	0.326**	0.320**	0.097**	0.290**	1					
K	0.152**	0.095**	0.074*	0.122**	0.126**	0.008	-0.119**	-0.029	-0.064	-0.029	1				
L	0.048	0.081*	0.023	0.098**	0.059	0.061	-0.018	0.021	0.010	-0.062	0.324**	1			
M	0.052	0.044	0.046	0.030	-0.024	0.045	0.005	-0.012	-0.001	-0.009	0.267**	0.494**	1		
N	0.023	0.065	0.072*	0.165**	0.116**	-0.020	-0.110**	0.001	-0.043	-0.066	0.378**	0.233**	0.315**	1	
O	0.090*	0.038	0.057	0.053	0.088*	0.015	-0.072*	0.006	-0.028	-0.112**	0.328**	0.335**	0.361**	0.382**	1

<sup>1)</sup> A: Health, B: Mood, C: Convenience, D: Sensory appeal, E: Price, F: Fruit, G: Snack, H: Beverage, I: Confection, J: Dairy Product, K: Work, L: Pay, M: Performance, N: People, O: Environment

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

#### Model fit test of the measurement model

The Structural Equation Model, which is a multi-variate analysis method that simplifies the process of making inferences on the causality among variables, is a technique that can analyze and evaluate interrelation among variables within the whole model and clarify the structural relationships among variables [23]. The present study selected the optimal model as well as

the optimal fit indices (CMIN/DF, IFI, CFI), which play a role in enhancing the fit of the model using the modification indices.

The structural equation model was used as the theoretical model to analyze sugar intake and job satisfaction in accordance with the food choices of industrial workers. Table 7 presents the results of the hypothetical model fit indices as  $\chi^2 = 2767.575$ , GFI = 0.874, AGFI = 0.852, IFI = 0.901, NFI = 0.843,

**Table 6.** Goodness of fit in confirmatory factor analysis

Model	$\chi^2$ <sup>21)</sup> (P-value)	$\chi^2/\text{df}$ <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	$P > (.05)$	2-3	.90-1	.90-1	.90-1	.90-1	.90-1	< 0.05	< 0.5
Hypothetical model	2,423.627 (.000)	2.166	0.886	0.865	0.921	0.862	0.920	0.054	0.039

<sup>1)</sup>  $\chi^2$ : Chi-square.

<sup>2)</sup>  $\chi^2/\text{df}$ : 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 7.** Hypothetical model fit index

Model	$\chi^2$ <sup>21)</sup> (P-value)	$\chi^2/\text{df}$ <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>
Goodness of fit criteria	$P > (.05)$	2-3	.90-1	.90-1	.90-1	.90-1	.90-1	< 0.05	< 0.5
Hypothetical model	2,767.575 (.000)	2.443	0.874	0.852	0.901	0.843	0.900	0.059	0.043
Result	unfit	fit	acceptable	acceptable	fit	acceptable	fit	acceptable	fit

<sup>1)</sup>  $\chi^2$ : Chi-square.

<sup>2)</sup>  $\chi^2/\text{df}$ : Chi-square divided by degree of freedom.

<sup>3)</sup> GFI: Goodness of fit index.

<sup>4)</sup> AGFI: Adjusted goodness of fit index.

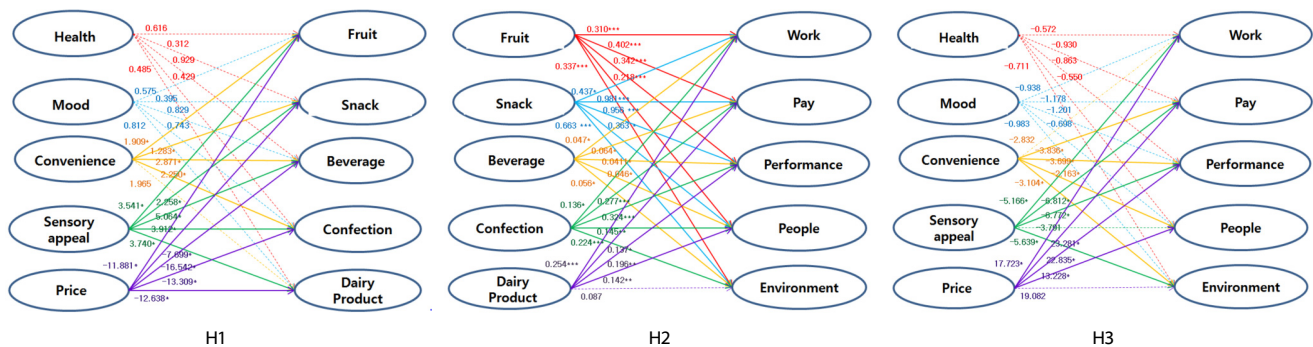
<sup>5)</sup> IFI: Incremental fit index.

<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 mean squared error of approximation.

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

CFI = 0.900, RMR = 0.059, and RMSEA = 0.043. Although the  $\chi^2$  value indicated a poor fit, the current research model in Fig. 1 was confirmed to be appropriate since the other indices like CMIN/DF, IFI, CFI, and RMSEA were proven to be appropriate, and GFI, AGFI, NFI and RMR satisfied the recommended standards.

## DISCUSSION

This research analyzes the food choices of industrial workers, presenting the effect of sugar intake on their food choices through the construction of a model on the relationship between the sugar intake pattern and job satisfaction. The audience for the surveys was industrial workers, and they were sampled during the period between May to July 2015.

Factor analysis was applied to: 17 questions related to food choice attribute, 16 questions related to sugar intake pattern and 18 questions related to job satisfaction. Questions in the food choice attribute category were grouped under 5 factors, as were sugar intake pattern and job satisfaction. The results of exploratory factor analysis showed that the Cronbach's alpha was nearly 0.6 or above for all factors, which established the reliability. Correlation analysis revealed that multicollinearity was not a problem with most of the variables since the highest correlation coefficient was 0.494. After factors were identified through exploratory factor analysis, confirmatory factor analysis of the measurement model was performed with AMOS to establish the validity. The  $\chi^2$  value was found to be unsuitable, but the other indices except for these two values were good enough to satisfy the recommended level.

The results of testing Hypothesis 1 showed that 'Price' had a significant negative (-) effect on 'Fruit', 'Snack', 'Dairy Product', 'Confection' and 'Beverage'. 'Sensory appeal' was found to have a significant positive (+) effect on 'Fruit', 'Snack', 'Dairy Product', 'Confection' and 'Beverage'. 'Convenience' had a significant positive (+) effect on 'Snack', 'Confection', 'Beverage' and 'Fruit', but not on 'Dairy Product'. 'Health' and 'Mood' did not have significant effects on 'Fruit', 'Snack', 'Beverage', 'Confection' or 'Dairy Product'. This result was in agreement with that of Yea [24], who reported that health and natural content scored the lowest for dessert choice attributes. On the other hand, Meiselman [25] reported that the influence of the environment on food choice affected the perception of food quality.

The results of testing Hypothesis 2 showed that the consumption of sugar in the form of fruits had a significant positive (+) effect on 'Work', 'Pay', 'Performance', 'People' and 'Environment'. The intake of sugar in the form of snacks was shown to have a significant positive (+) effect on 'Performance', 'Pay', 'Environment', 'People' and 'Work' while the intake of sugar in the form of beverages had a significant positive (+) effect on 'Pay', 'Environment', 'Work', 'People' and 'Performance'. The intake of sugar in the form of confections was found to have a significant positive (+) effect on 'Performance', 'Pay', 'Environment', 'People' and 'Work'. In contrast, the consumption of sugar in the form of daily products was found to have a significant positive (+) effect on 'Work', 'Performance', 'People', and 'Pay', but not on 'Environment'. Similar results were reported by Yan [26]. In this previous study, sugary food was consumed more often when satisfaction with school life was higher. This study found that all sugar intake patterns affect the job satisfaction of industrial workers. Therefore, the results obtained in this study would be useful for the development of a sugar reduction policy or project plans involving the relationship between sugar intake pattern and job satisfaction.

The results of testing Hypothesis 3 showed that 'Price' had a significant positive (+) effect on 'Pay', 'Performance', 'Environment', 'Work' and 'People'. 'Sensory appeal' was shown to have a significant negative (-) effect on 'Performance', 'Pay', 'Environment' and 'Work', but not on 'People'. 'Convenience' had a significant negative (-) effect on 'Pay', 'Performance', 'Environment' and 'People', but not on 'Work'. 'Health' and 'Mood' did not have significant effects on 'Work', 'Pay', 'Performance', 'People' or 'Environment'. Job satisfaction affects work behavior and organizational performance [27]. A study evaluating the breakfast eating habits of workers found that breakfast boosted job satisfaction and had a positive effect on work efficiency [28]. Ryu [22] also reported that income did affect the job satisfaction of workers. The study demonstrated that the higher the average monthly income is, the higher the level of job satisfaction. According to the present study, 'Price' was found to have a significant positive effect on all aspects of job satisfaction. This may have been because 'Price' is one of the most important food choice attributes for industrial workers.

The results of this study provide exact data on the food choices of industrial workers and demonstrate the effects on their sugar intake pattern and job satisfaction. The results can be used as basic data to determine the right food choices, optimal diets and suitable nutrition policies in the future with

proper regulation of sugar intake. Additionally, a national support policy is necessary for the continued maintenance and development of a variety of programs that facilitate job satisfaction for industrial workers and promote personal education guidelines.

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