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Workplace and individual factors influence eating practices of Thai factory workers

Pattaraporn Charoenbut[1], Jeeranun Klaewkla[1*], Suwat Srisorrachatr[1], Sara Arphorn[2] & Somtawin Wijitwanna[3]

[1]*Department of Nutrition, Faculty of Public Health, Mahidol University, Bangkok, 10400, Thailand;* [2]*Department of Occupational Health and Safety, Faculty of Public Health, Mahidol University, Bangkok, 10400, Thailand;* [3]*Office of Registration, Records and Evaluation, Sukhothai Thammathirat Open University, Nonthaburi, 11120, Thailand*

ABSTRACT

Introduction: The promotion of healthy eating practices in the workplace could reduce the burden of morbidity in the working population. Eating practices of employees are the result of multiple factors. This research aimed to examine the association between workplace and individual factors related to eating practice among factory workers by using the hierarchical linear modelling. **Methods**: Data were obtained from workers and managers in 26 factories located in a central province of Thailand. Workers completed self-administered questionnaires about individual data and eating practices including consumption of foods high in fat, salt and sugar. Factory managers were interviewed along with a survey of the worksite nutrition environment. **Results**: The multilevel modelling of data from 26 managers and 924 workers showed that none of the workplace factors studied predicted the employees' eating practices, i.e. workplace policy, attitude toward food and nutrition promotion of management personnel, healthy food in canteen, and workplace nutrition environment. At the individual level, attitude towards diet and health of factory workers was associated with eating practices (b=48.67, SE=1.71). Cross-level interactions between workplace nutrition environment and canteen management attitude towards health and diet of workers, were significantly associated with eating practices. This finding indicates that nutrition promotion at the workplace should take into consideration the key factors of offering healthy foods in canteens and supporting a healthy nutrition environment. **Conclusion**: Worksites should be encouraged to provide a healthy nutrition environment and offer healthy food choices in their canteens.

Keywords: Eating practice, workplace, nutrition environment, multilevel analysis

INTRODUCTION

Non-communicable diseases (NCDs) are a growing health problem throughout the world (WHO, 2013). Among these, cardiovascular disease, cancer and diabetes are now the leading causes of death among adults worldwide. In Thailand, the proportional mortality from NCDs was 71% of total adult deaths (WHO, 2014). Several studies have shown that dietary factors, such as higher levels of fibre, fruit and vegetable consumption, are associated with reduced risk of developing cancer,

*Corresponding author: Jeeranun Klaewkla
Department of Nutrition, Faculty of Public Health, Mahidol University, Bangkok 10400, Thailand
Tel: +66 2354 8539, 2354 8543-9 ext 1205; Fax: +66 2640 9839; E-mail: jeeranun.kla@mahidol.ac.th

diabetes and cardiovascular diseases (Nishida, Shetty & Uauy, 2004). Public health organisations are promoting healthy eating behaviours to adults in both community and workplace settings to slow the spread of NCDs.

While there are various types of workplaces in Thailand, the expansion of industrialisation has resulted in an increased number of industrial workers. The industrial workforce is socio-economically and culturally diverse. Due to restrictive work schedules, workers dietary choices during working hours are based on their daily life activities and may not be healthy. For instance, it is more convenient and quicker to buy snacks or foods from the workplace canteen than to buy a nutritious meal from outside the factory. Food habits and eating patterns of factory workers were impacted by the constraints of their work in the factory setting (Thornton *et al.*, 2013; Price *et al.*, 2016). Another study by Manasigan *et al.* (2015) reported that one-third of the factory workers consumed high fat food every day and had a low frequency of daily fruit intake. A study of Thai workers in a garment factory found that most of the workers ate at the cafeteria at least once a day, and were likely to choose unhealthy foods such as fried foods and sweets (Boontem, 2007).

Poor eating patterns can lead to low work productivity, increased absenteeism, increased medical expenses, and increased morbidity (Asay *et al.*, 2016). In order to reduce rising health care costs due to unhealthy eating practices, it was suggested by the European Network for Workplace Health Promotion (ENWHP) that employers should implement plans that promote healthy dietary behaviours among their workers (Muylaert, Beeck & Broek, 2007).

Workplace nutrition interventions to improve eating behaviours had been studied extensively (Allan *et al.*, 2017; Geaney *et al.*, 2013; Kushida & Murayama, 2014). However, there is limited empirical evidence that examines the association of individual and workplace factors on the eating practices of factory workers. There are multiple levels of association between workplace and individual factors on eating behaviours. According to the previous reviews, the workplace can play a role in promoting health, since the workers are grouped in the same organisational nutrition environment influenced by political, physical, social, economic aspects of the workplace (Glanz *et al.*, 2005). Previous studies mostly focused on the physical nutrition environment, i.e. available foods. Hence it was suggested that studies on employee eating behaviours should include the economic, political, and socio-cultural factors of the workplace (Ni Murchu *et al.*, 2010).

Eating practices were defined as behaviours that are consistent with a level of health, where poor health is linked to diets with high fat, sugar or salt levels. The eating practices of employees are influenced by multiple factors at the level of the individual, including psychosocial and socioeconomic (Florindo *et al.*, 2015), past participation of nutrition promotion programmes (Mhurchu, Aston & Jebb, 2010), and characteristics of their work. The workplace may influence a person's eating practices with health promotion campaigns (Mhurchu *et al.*, 2010), providing social support for improving eating habits (Tamers *et al.*, 2011), the types of food that are available in workplace canteen (Bandoni *et al.*, 2011), and the general approach to nutrition in the work environment (Story *et al.*, 2008).

The purpose of this research was to determine the associations between factors at the workplace and eating practices among factory workers. The hierarchical linear model (HLM) or

multilevel model analysis is applied and the research outcome HLM is referred as mixed models, multilevel models, and random effect models (Goldstein, 2011; Faraway, 2016).

MATERIALS AND METHODS

Participants and settings

This study used a cross-sectional design. The research settings were industrial factories located in Muang, Bang Plee, and PhraPraDaeng districts in SamutPrakarn province, Thailand. The team used the Power IN Two-level (PINT) design software (Version 2.1) to determine the optimal sample size for the multilevel research design, using data from the 2007 health risk screening of 2,505 insured workers, collected by Thai Social Security Office (Samut Prakarn Provincial Health Office, 2007). Permission to use the data was obtained from Samut Prakarn Provincial Health Office. The alpha (α) was set at 0.01, the power was set at 0.80, and 0.10 for the effect size. The standard error was 0.034, which satisfied the power (0.80). The estimated sample size for the workplace level factors was 22 factories, and 880 workers for the individual level factors.

Participating factories were recruited according to criteria on diverse size and types of industrial production. Among the participating factories selected by convenience were six that produce household utensils, five build automobiles, four produce textiles, four each were chemicals and food producers, and three that specialised in metal or steel products. Eligible workers were selected using quota sampling techniques to ensure that two equally sized subgroups of manual and non-manual workers were represented. The research team selected the quota sampling technique because it is suitable for conducting research with heterogeneous populations (Sekaran & Bougie, 2012).

Research instrument

The research instruments consisted of separate tools designed for managers and workers. Studied variables were derived from the major domains in a Conceptual Model of Community Nutrition Environments (Glanz *et al.*, 2005), which comprised policy, environmental and individual variables related to eating behaviour. This study also used semi-structured interviews with managers and a validated questionnaire with workers.

The questionnaire was developed by the researchers based on the Checklist of Health Promotion Environments at Worksites (CHEW) (Oldenburg *et al.*, 2002) and the Nutrition Environment Measures Survey in Stores (NEMS-S) (Glanz *et al.*, 2007). After receiving feedback and recommendations from the advisory committee, the Index of Item-Objective Congruence (IOC) was used to determine the content validity. The Cronbach's alpha values were 0.81 for eating practice, 0.84 for perception of support for nutrition in the workplace, 0.67 for attitude toward healthy eating, 0.87 for perception of social support, and 0.78 for knowledge on healthy eating practices.

The description of the instruments is shown in Table 1. There were two levels of measurement. Level 1 individual level measurement consisted of work characteristics, knowledge and attitude, social and environment support, and eating practice. Level 2 workplace level measurement consisted of policy and plan for nutrition promoting, worksite nutrition environment, healthy food choice in canteen, and manager's attitude toward nutrition.

Data collection

Data collection was carried out from March-June 2011. The researcher made the appointment with each factory

Table 1. Description of research instruments

Measurement items and description	*Coding*
Level 1 Individual level measurement	
Job type	manual = 1, non-manual = 0
Nutrition programme participation	yes = 1, no = 0
Work schedule	shift work = 1, non-shift work = 0
Knowledge	
• 10 items about Thai dietary guideline, nutrient content in food, and diet relating to chronic diseases.	correct = 1, incorrect = 0
Attitude toward diet and health	
• 10 items about foods and health	positive attitude = 1, negative attitude = 0
Social support	
• 14 items about social support for healthy eating habits, including families, co-workers or bosses, and health care providers.	never=0, sometimes=1, often=2, very often=3
Environment support	
• 12 items of supportive worksite food environments for healthy eating	very much = 3, moderate =2, little = 1, none = 0
Eating practice	
• 12 items about eating practices in the previous six months. The frequency of consuming of high fat, high sodium, and high sweet foods.	never or less than once/month = 6, 1 time/month = 5, 2-3 times/month = 4, 2-3 times/week = 3, 4-6 times/week = 2, once/day = 1, more than 2 times/day = 0
Level 2 Workplace level measurement	
Policy and plan for nutrition promoting	
• Having written policy regarding food and nutrition promotion	Written policy = 2, verbal policy = 1, no = 0
• 4 items of having plan, budget, staff responsibility, and nutrition activities	yes = 1, no = 0
Worksite nutrition environment	
• 16 items about canteen management, place to eat outside the canteen, information, food welfare, and supportive facilities	yes = 1, no = 0
Healthy food choice in canteen	
• 5 items about availability of 1) fresh fruit, 2) vegetable, 3) milk, 4) whole grain rice, and 5) healthy menu.	yes = 1, no = 0
Manager's attitude toward nutrition	
• 9 items about importance of food and nutrition promoting for employees	unsure=0, less important=1, moderate=2, important=3, very important=4

manager to ensure all selected subjects could participate in the research. The individual questionnaires were distributed to 969 workers in all the selected factories during their break time which was approximately 30 minutes. A total of 42 sets of questionnaires were excluded as the workers did not answer more than two parts of the questionnaire. Three workers did not meet the inclusion criteria (two lactating women and one student trainee). In total, 26 management persons and 924 workers were included in the study. The researcher conducted individual interviews with the management personnel who were responsible for health promotion activities. After the interviews, the researcher asked for permission to observe the canteen and other eating locations.

Statistical analysis

Descriptive statistical analysis was performed using the Mahidol University Licensed version 17.0 of the Statistical Package for the Social Sciences (SPSS) software package. In order to investigate the associations between workplace-level factors, individual-level factors, and workers' eating practices, the research team applied version 7.0 of the Hierarchical Linear and Nonlinear Modeling produced by Scientific Software International, Inc. The two-level HLM analyses followed guidelines contained in Raudenbush and Bryk's book and in the software manual (Raudenbush & Bryk, 2002). HLM is also referred to as mixed models, multilevel models, and random effect models (Raudenbush & Bryk, 2002). HLM was more suitable for analysing the shared variance of grouped data with the different levels of explanatory factors than the traditional regression models.

Ethical considerations

The research protocol was approved by the Mahidol University Ethics

Table 2. General information about participating factories and workers

Characteristics of factory (n=26)	*n*	*%*
Location of factory		
Bangplee district	3	11.5
Muang district	19	73.1
Phrapadaeng district	4	15.4
Size (number of employees at factory)		
<100	2	7.7
100-499	11	42.3
500-1000	8	30.8
>1000	5	19.2
Labour union		
With labour union	10	38.5
Without union labour	16	61.5
Characteristics of the workers (*n*= 924)		
Male	402	43.5
Female	522	56.5
Age (year)		
<20	22	2.4
21-30	208	22.5
31-40	361	39.1
41-50	227	24.6
>50	106	11.5

Committees for Human Research in the Faculty of Public Health, (Reference Number: *MUPH 2011-012*). All participants were informed about the research objectives, procedures, and their human rights. Consent forms with a brief description of the study were distributed to all participants. They were asked to sign and return the consent forms to the researchers before data collection.

RESULTS

Background description of 26 managers and 924 workers are shown in Table 2. About half of the participants were manual workers (52.8%), and some of them engaged in shift work (27.4%).

Table 3 provides a summary of the descriptive results of both the outcome and the independent factors that were included in the 2-Level Hierarchical Linear Model. The mean score of eating practice was 46.75, with 35.2% of the participants had very low score of eating practice. This finding indicates that most of participants had poor eating practices. A relatively small percentage of workers had participated in nutrition programmes (17.6%). Knowledge level about healthy eating habits was moderate (Mean±SD=6.07±1.87). The participants had good attitude on healthy eating as the average score was 7.60±1.80. The perception scores of workers about the social and environment support in the worksite for nutrition were quite low (19.19±7.61, 15.19±6.50, respectively). The result was consistent with the incidence of policies and plans for nutrition promotion were quite low (1.31±1.67).

The two-level hierarchical linear model evaluated the associations of level 2 or workplace level factors and level 1 or individual level factors on worker's eating practices. This study found that the null model showed significant variations in workplace means τ_{00}=3.47, p<0.001) indicating that the average eating practice score varied significantly

Table 3. Descriptive results of outcomes and the independent factors in a two-level hierarchical linear model

Factors	*Mean*	*%*	*SD*	*Min*	*Max*
Eating practice score†	46.75		10.43	3	70
Very low (0-15)		35.2			
Low (16-30)		26.7			
Moderate (31-45)		23.6			
High (46-72)		14.5			
Individual level					
Job type (manual workers)		52.8			
Have experience of nutrition programme participation		17.6			
Work schedule (shift workers)		27.4			
Knowledge	6.07		1.87	0	10
Attitude toward diet and health	7.60		1.80	0	10
Perception of social support	19.19		7.61	0	42
Perception of worksite environment support	15.19		6.50	0	36
Workplace level					
Policy and plan for nutrition promoting	1.31		1.67	0	6
Worksite nutrition environment	10.12		2.86	5	16
Healthy food choice in canteen	2.54		0.99	0	4
Manager's attitude toward nutrition	29.19		3.42	24	36

†Range score 0-72 for eating practice

across the factories. The intra-class coefficient (ICC) of 0.32 indicates that about 32% of the total variability in eating practices could be attributed to the workplace. Meanwhile 17% of eating practice variance could be explained by the factors at the individual level.

As seen in Table 4, at the individual level, there was significant association with the worker's attitude towards diet and health (*b*=48.67, *SE*=1.71). At the workplace level, the average eating practice scores varied significantly among the 26 participating factories by an estimated intercept of 49.06 (*SE*=2.02). Other variables that had no significant effect on the eating practices of workers included workplace policy, the attitude of management, the availability of healthy food choices in the canteen, and the worksite nutrition environment. The cross-level interaction showed negative and statistically significant associations between healthy food choice in the workplace canteen, and between individual's attitude and eating practice (p<0.01). There was a positive interaction between worksite nutrition environment and the attitude about diet and health of employees and eating practice (p<0.01).

DISCUSSION

In previous studies, workplace factors that were linked to improved eating habits of workers included food-related policies, health and nutrition promotion, creating a supportive nutrition environment, and offering healthy foods in the workplace canteen (Bandoni *et al.*, 2011; Mache *et al.*, 2010; Quintiliani, Poulsen & Sorensen, 2010; Risica *et al.*, 2018). However, this study did not find a similar influence of the workplace. The contrast between the results of our study and others may be attributable to the differences in research designs.

Attitude is one psychosocial determinant of eating more fruit, vegetables and less fat (Risica *et al.*, 2018). This study found similar results

Table 4. Two-level hierarchical linear models of the workplace and individual level predictors of factory workers' eating practices

Variables	*b*	*SE*	*t-ratio*
Level 1 (individual level)			
Intercept	48.67**	1.71	28.52
Job type	-1.18	0.70	-1.70
Nutritional knowledge	-0.13	0.21	-0.63
Attitude towards diet and health	1.67**	0.22	7.44
Perception of social support	0.08	0.04	1.77
Perception of worksite environment support	0.01	0.08	0.14
Attending nutrition programme	0.16	0.89	0.18
Work shift	-0.04	0.68	-0.06
Level 2 (Workplace level)			
Intercept	49.06**	2.02	24.34
Policy	0.38	1.49	0.25
Manager's attitude	0.01	0.67	0.02
Healthy food choice in canteen	1.50	2.68	0.56
Worksite nutrition environment	-1.12	1.05	-1.06
Cross-level			
Healthy food choice in canteen and manager's attitude	-0.92**	0.30	-3.11
Worksite nutrition environment and manager's attitude	0.35**	0.11	3.06

**p-value<0.001

as the study by Naughton *et al.* (2015), which revealed that personal attitudes were significant predictors of healthy eating among adults.

This study's finding of a negative association between availability of healthy food in the canteen and positive attitude of the workers and lower frequency of purchasing canteen food should be interpreted with caution.

This study focused on studying food items sold in canteen but not outside the factories. Monsikarn (2015) found that workers who were not restricted from purchasing food from nearby food stalls outside the factories were likely to consume less healthy foods. An explanation why the workers preferred to eat food outside the factory despite having more healthful food options in the factory canteen could be due to the preference for the tastes of outside food (Aggarwal *et al.*, 2016; Monsikarn, 2015).

The finding of a positive statistically significant cross-level interaction of the workplace nutrition environment and the worker attitude and the eating practice appears to suggest that the higher the supportive nutrition environment score and attitude score, the less frequent the consumption of unhealthy foods. This result is similar to the finding by Watkins *et al.* (2008), who found that the employee's food choices were significantly influenced by their perception of the food quality in the workplace and time constraints. In addition, previous studies pointed out that the barriers to healthy eating include a lack of facilities to prepare, cook and store healthy foods (Nicholls *et al.*, 2017). Having good attitude towards healthy eating can be enhanced by creating a healthy food environment in the workplace (Glanz *et al.*, 2005).

Limitations and strengths

The limitations of this research include: the use of a non-probability sampling method, which may limit representativeness of the samples. Secondly, data about the perceptions of both management personnel and workers were determined using subjective criteria. Thirdly, limitations include recall bias for assessment of eating practice for the past six months and lack of confounding adjustment.

The major strengths of the research are that, to the best of our knowledge, this is the first study to use a multilevel modelling approach to examine multiple level factors relating to the eating practices of Thai factory workers.

CONCLUSION

Eating habits are influenced by multiple factors related to both workplace and individual levels. Strategies to promote healthy eating among factory should include two key elements:

i) Improve motivation of employees to consume healthful and tasty food options in the workplace canteen, and
ii) creating an environment in the workplace that is supportive of nutrition and healthy eating practices.

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Authors' contributions

CP wrote the manuscript; KJ offered final approval of the version to be submitted and any revised version; SS drafted the article and revising it critically for important intellectual content; AS supported in the data collection and revising it

critically for important intellectual content; WS analysed the data and revising it critically for important intellectual content.

Conflict of interest

There was no conflict of interest in this study.

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