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Factors Affecting Food Production with Hygienic Conditions of Bangchang Housewife Group in Bangchang Community, Amphawa District, Samut Songkhram Province

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ABSTRACT
This research purposed to study 1) the level of knowledge and understanding of Primary good manufacturing practice (GMP), including basic knowledge of Primary GMP, sanitation and hygienic operations, and safe food production process; 2) the level of management controls for Primary GMP; and 3) capabilities for explaining the variance in levels of knowledge of Primary GMP. The research sample included 44 persons in the Bangchang Housewife Group, Samut Songkhram Province. A questionnaire served as the research instrument for collecting data from the samples. Descriptive statistics used in the research consisted of mean, standard deviations, percentages, *t*-tests and correlation coefficients using multiple regression analyses. The study proved that the overall level of knowledge of Primary GMP was fair, which reflected a moderate level of understanding. Consequently, the mean and standard deviation statistics equated to 3.13 and 0.40 ($\bar{X}$ = 3.13, *SD* = 0.40). Statistically, the results indicated a positive relationship between the premise-based audit and reputation. No negative indicators for public relations, housewife group's need, and product presentation were found, with a statistical significance level of 0.05. According to the results, basic knowledge of Primary GMP and safe food production processes can explain the Bangchang Housewife Group's satisfaction with the Primary GMP. This study's findings contributed new knowledge on Primary GMP in different areas and helped raise product value.

Keywords: Food production, hygienic conditions, administration, Primary GMP

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INTRODUCTION

Good manufacturing practice (GMP) encompasses the essential requirements for all aspects of food production: hygienic design, premises and building; utensils and equipment; starting materials; manufacturing and storage areas; sanitation and hygienic operations; disinfection procedures; distribution; and neighborhood (Pachler et al., 2017; Wuchter et al., 2015). GMP is necessary to ensure a consistent finished product that conforms to all required food safety, quality, and consumer attribute conditions (de Oliveira et al., 2018; Unger et al., 2008). The GMP standard emphasizes the prevention of any risk that may affect consumers. It constitutes a type of quality control that consists of procedures recommended and approved by food experts. As such, the more closely the GMP standards are followed, the better and safer the quality of the items produced (Anantasiri, 2014; Bavornniraman, 2011). GMP also involves practices within the organization and management system, including training programs; procurement; inventory and facilities management; quality control and assurance; and research and product development (Sokolowska et al., 2020; Souto et al., 2020). Thus, those manufacturers interested in acquiring GMP certification should strictly emphasize GMP guidelines (Manning, 2018). To obtain GMP certification and initiate consumer trust, the manufacturer or producer must demonstrate effective process management (Panriansaen, 2011).

The Bangchang Housewife Group (BHG) is one of the local community enterprises for manufacturing local food products launched in Thailand. The BHG, located in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand, is considering seeking GMP certification to ensure customers receive quality products. Therefore, the BHG is interested in adopting GMP guidelines (Primary GMP) to meet the needs of its group members (Food Division, 2020).

Management of Primary GMP in the BHG food production industry would raise the standards of products produced in the BHG to the level of best products. Even though most food production operators in the BHG need GMP certification, they do not know how to acquire that certification and do not understand the requirements for obtaining it. Therefore, the researchers sought to study the factors affecting the hygienic design and GMP compliance of food production manufacturers in the BHG in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand. This study may increase the capacity of the local community enterprises, especially the BHG food and pharmaceutical businesses, to promote their products more competitively and expand their market scale.

Study Objectives

1. To study the level of basic knowledge and understanding of Primary GMP and knowledge and understanding of sanitation and hygienic operations and safe food production processes in the BHG in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.

2. To study the level of management controls for Primary GMP compliance related to sanitation and hygienic operations in BHG food production companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.
3. To study the capability to explain the variation in levels of knowledge of Primary GMP in BHG food production companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.

Hypothesis

1. The levels of knowledge and understanding of basic Primary GMP and related sanitation and hygienic operations and safe food production processes affect the Primary GMP satisfaction of BHG food production companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.
2. Management controls for Primary GMP compliance affect the sanitation and hygienic operations of BHG food production companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.
3. Basic knowledge of Primary GMP can explain the variance in levels of satisfaction with the Primary GMP of BHG food production companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand.

RESEARCH METHODOLOGY

A quantitative technique was used in this study to obtain data such as demographic characteristics, including age and income, gathered through a survey instrument. The descriptive statistics used in this research were frequency, percentage, mean, and standard deviation. A stepwise multiple regression analysis was employed to measure levels of satisfaction with Primary GMP. This research also included an analysis of the levels of knowledge and understanding of Primary GMP, sanitation and hygienic operations, and safe food production processes that comply with Primary GMP standards using frequency, mean, standard deviation, and Pearson Product Moment Correlation Coefficient. In addition, the study involved an analysis of the data to determine levels of satisfaction with Primary GMP. According to the stepwise multiple regression analysis, the tools used for data collection gathered four types of information: demographic characteristics, management controls for Primary GMP compliance with sanitation and hygienic operations, basic knowledge of Primary GMP, and finally, satisfaction with Primary GMP standards.

Population and target group

The target population included 50 food manufacturing operators who worked in BHG food production manufacturing companies in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand. The final study population comprised 44 food operators identified through random sampling from BHG food manufacturers in Bangchang Community, Amphawa District, Samut Songkhram Province.

Research Instrument

The data for this research were gathered using a questionnaire divided into the following five sections: Section 1—demographic characteristics; Section 2—management controls for Primary GMP compliant hygienic and sanitation operations; Section 3—factors affecting knowledge and understanding of Primary GMP; Section 4—satisfaction with Primary GMP; and Section 5—recommendations. The authors designed a research measurement focused on content accuracy, reliability, and validation. Multiple questions in the questionnaire were gleaned from a literature review on variables that were proven by experts.

Reliability

1. Try 30 non-samples.
2. Calculate the reliability of the multiple-question survey using Cronbach's coefficient alpha (Conbach, 1984). Cronbach's alpha for Section 2 of the questionnaire on the management controls for Primary GMP compliance equaled .70. Cronbach's alpha for the section focused on factors affecting knowledge and understanding of Primary GMP was .75. Finally, Cronbach's alpha for the section pertaining to satisfaction with GMP was .80.
3. Use the improved questionnaire to collect data from the BHG.

Data collection

1. The researchers submitted an official Permission Letter for Research and questionnaires to the BHG leaders in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand and informed them of the research objectives. Furthermore, the researchers assured respondents that participation in this study would not affect their work.
2. The researchers collected data within a specific timeframe.
3. After receiving the questionnaires, the researchers checked the data quality, then established codes for the data and classified the data according to those codes, and then scored and analyzed the data using the Statistical Package for Social Sciences (SPSS).

Data analysis

1. Analysis of respondents' levels of knowledge and understanding of Primary GMP, sanitation and hygienic operations, and safe food production processes that comply with Primary GMP standards.
2. Analysis of the management controls for Primary GMP compliant hygienic and sanitation operations by mean, standard deviation, and Pearson's correlation coefficient as reported by respondents.
3. Analysis of the knowledge of Primary GMP and satisfaction with Primary GMP of respondents.

RESULTS

The study participants comprised 44 food operators who worked in the BHG in the Bangchang Community, Amphawa District, Samut Songkhram Province of Thailand. Most respondents (79.54%) were over 60, while 20.45% ranged in age between 51–60 years old. Most (70.45%) reported earning between 5,001–10,000 Baht per month. More than half of respondents (56.08%) possessed a fair level of knowledge and understanding of Primary GMP in general, according to the survey data. Moreover, most respondents (67%) indicated a good level of knowledge and understanding of safe food production processes, while 59% reflected a fair level of knowledge about sanitation and hygienic operations. In addition, most respondents neutralized with the list of organizational support ($\bar{X}$ = 3.03, *SD* = .339) that subordinated to the accessibility of information sources ($\bar{X}$ = 3.18, *SD* = .456), with which most samples agreed. By each list, according to government support, most respondents also neutralized

with performance tracking ($\bar{X}$ = 3.70, *SD* = .462) prior to providing information on GMP advantages ($\bar{X}$ = 3.45, *SD* = .504). In addition, according to the accessibility of information sources, most respondents agreed with the premise-based audit and product presentation ($\bar{X}$ = 3.45, *SD* = .504).

Table 1 presents the results of the data analysis pertaining to the level of knowledge and understanding of GMP of the 44 food operators who worked in the BHG in Bangchang Community, Samut Songkhram Province of Thailand who participated in the study. The results indicated that more than half of the respondents (56.08%) possessed a fair level of knowledge and understanding of GMP in general. Approximately 59% of respondents had a fair level of knowledge and understanding of sanitation and hygienic operations as well. On the contrary, the majority indicated possessing a good level of knowledge and understanding of the safe food production processes.

Table 1: Level of knowledge and understanding of GMP.

Measure	Frequency		Percentage	Level of knowledge and understanding
	Knowledgeable	Not Knowledgeable		
Basic knowledge of Primary GMP				
1. Primary GMP is an essential good manufacturing practice and general hygienic requirement.	26	18	49.1	Fair
2. Primary GMP is a quality assurance system related to product safety.	26	18	49.1	Fair
3. Premises and neighborhoods must not be easy to contaminate.	37	7	69.8	Good
4. Production plant is of a suitable size and convenient for operation.	39	5	73.6	Good
5. Production plant must be located in a separate area from the rest of the company.	29	15	54	Fair
6. Primary GMP ensures consumers that the food products they purchase are safe.	41	3	77.4	Good
7. Primary GMP helps to prevent defects that can occur in the production process.	34	10	64.2	Good
Management controls for sanitation and hygienic operations				
1. Attire (hair restraints, coveralls, footwear) must be clean.	26	18	49.1	Fair
2. Operators must wear facial masks at all times in the manufacturing area.	26	18	49.1	Fair
3. Production plant must control sanitation and hygiene within production operations.	29	15	54.7	Fair
4. Toilets, sinks, and drains shall be separated from other areas.	37	7	69.8	Fair
5. Operators must wash hands before entering the manufacturing area or putting on gloves.	39	5	73.6	Fair
6. Utensils and equipment must be cleaned before and after use.	29	15	57.7	Fair
GMP Safe Food Manufacturing Processes				
1. GMP must have a record, report, and product analysis for at least 2 years.	19	15	54.7	Fair
2. Utensils and equipment must be checked for cleanliness before each use.	44	0	100	Excellent
3. Premises must be constructed in a way that protects against access by insects or animals.	34	10	64.2	Good
4. Utensils and materials used in production must not be contaminated and must not react to food. They must be non-toxic and clear of rust.	29	15	54.7	Fair
5. Production plant must be inspected for dry, wet, and damp areas.	39	5	73.6	Good
6. Unused packaging must be retained. Do not destroy.	29	15	54.7	Fair

As the note for Table 2 illustrates, the multiple correlation equated to .47, and its coefficient of determination was .22. Knowledge and understanding explained a significant variance in levels of satisfaction of Primary GMP: R^2 = .22, F = 6.646, p < 0.05. The research revealed that the majority of BHG respondents from Bangchang Community were satisfied with the Primary GMP process for sanitation and hygienic operation. This result implied that knowledge of GMP safe food production processes and sanitation and hygienic operations significantly affected levels of satisfaction with Primary GMP at a significance level of 0.5. Thus, the levels of knowledge and understanding of basic Primary GMP and related sanitation and hygienic operations and safe food production processes can describe satisfaction with Primary GMP, accounting for 22%, which was related to Hypothesis 1.

Table 2. Regression coefficients and statistics of knowledge and understanding towards satisfaction of Primary GMP on the topics of basic knowledge of Primary GMP, sanitation and hygienic operation, and GMP process obtained from Multiple Regression Analysis (N = 44)

Measure	Unstandardized Coefficients		Unstandardized Coefficients	*t*	*p*-value
	β	Std. Error	β		
Constant	4.124	.268		15.384	.000*
GMP Process	-1.129	.391	-.416	-2.890	.006*
Sanitation and hygienic operation	.498	.193	.371	2.578	.014*

Note: p-value < 0.05, R = .47, R^2 = .22, F = 6.646

Table 3 shows the level of management controls for Primary GMP compliance with sanitation and hygienic operations of the BHG food manufacturers in Bangchang Community, Amphawa District, Samut Songkhram. The research found that most respondents indicated neutral levels of agreement with the list of organizational support ($\bar{X}$ = 3.03, *SD* = .339). For each list, most respondents also indicated neutral levels of agreement with performance tracking ($\bar{X}$ = 3.70, *SD* = .462) prior to providing information on GMP advantages ($\bar{X}$ = 3.45, *SD* = .504). In addition, according to the accessibility of information sources, most respondents agreed with the premise-based audit and product presentation ($\bar{X}$ = 3.45, *SD* = .504). These results relate to in Hypothesis 2.

Table 3: Management controls for Primary GMP compliance of Bangchang Housewife Group in Bangchang Community, Amphawa District, Samut Songkhram (N = 44)

No.	List	$\bar{X}$	*SD*	Level of agreement
Organizational support for Primary GMP		**3.09**	**.339**	**Neutral**
1	Government support	3.11	.321	Neutral
2	Providing information on GMP advantages	3.45	.504	Agree
3	Campaign on asking permission for food production following Primary GMP	3.00	.000	Neutral
4	Cost support for asking permission for food production following Primary GMP	2.20	.408	Disagree
5	Performance tracking	3.70	.462	Agree
Accessibility to information sources		**3.18**	**.465**	**Neutral**
1	Government public relations	3.11	.321	Neutral
2	Premise-based audit	3.45	.504	Agree
3	Need for asking permission for food production following Primary GMP	2.52	.505	Disagree
4	Product presentation for Primary GMP	3.45	.504	Agree
5	Reputation for Primary GMP	3.39	.493	Neutral

As shown in Table 4, statistically, the results indicated a positive relationship between the premise-based audit and reputation. No negative indicators were found on public relations, BHG need, and product presentation, with a statistical significance level of 0.05.

Table 4 Correlation matrix (Pearson Product Moment Correlation Coefficient) of management controls for Primary GMP compliance and satisfaction of Primary GMP

Measure	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
Management Controls for Primary GMP Compliance			1											
Government support	3.11	0.32	0.14	1										
Providing information on GMP advantages	3.45	0.50	0.00*	0.23	1									
Campaign on asking permission for food production	3.00	0.00	0.89	0.33	0.54	1								
Cost support	2.20	0.40	0.70	0.98	0.95	0.45	1							
Performance tracking	3.70	0.46	0.00*	0.63	0.00*	0.50	0.60	1						
Public relations	3.11	0.32	0.14	0.00*	0.23	0.33	0.98	0.63	1					
Premise-based audit	3.45	0.50	0.00*	0.23	0.00*	0.54	0.95	0.00*	0.23	1				
Housewife group's need	2.52	0.50	0.02*	0.20	0.36	1.00	0.05*	0.61	0.20	0.36	1			
Product presentation	3.45	0.50	0.00*	0.23	0.00*	0.54	0.95	0.00*	0.23	0.00*	0.36	1		
Reputation	3.39	0.49	0.01*	0.95	0.04*	0.20	0.27	0.18	0.95	0.04*	0.20	0.04*	1	
Satisfaction of GMP	3.57	.316	0.21	0.61	0.12	0.02*	0.30	0.70	0.61	0.12	0.31	0.12	0.20	1

Note: *p-value < 0.05, *M* = mean, *SD* = standard deviation
1 = Management Controls for Primary GMP Compliance
2 = Government support
3 = Providing information on GMP advantages
4 = Campaign on asking permission for food production
5 = Cost support
6 = Performance tracking
7 = Public relations
8 = Premise-based audit
9 = Housewife group's need
10 = Product presentation
11 = Reputation
12 = Satisfaction with GMP

As Table 5 indicates, the multiple correlations equated to .52. Knowledge explained a significant proportion of Primary GMP variance, basic knowledge of Primary GMP, sanitation and hygienic operations, and safe food production processes: R^2 = .28, F = 5.821, p < 0.05. The results imply that most operators in the BHG in Bangchang Community who participated in the study had a basic understanding of Primary GMP as an essential quality assurance system for product safety, good manufacturing practices, hygienic requirements, and a two-year record or a report, and product analysis. These results relate to in Hypothesis 3.

Measure	Unstandardized Coefficients		Unstandardized Coefficients	*t*	*p*-value
	β	Std. Error	β		
Constant	3.417	.069		49.539	.000
1. GMP is a basic quality assurance system for product safety.	-.205	.085	-.323	-2.413	.020
2. GMP reflects good manufacturing practices and hygienic requirements.	.249	.085	.392	2.933	.005
3. GMP must have a record, report, and product analysis for at least 2 years.	-.251	.094	-.380	-2.664	.011

Table 5. Regression coefficients and statistics of knowledge and understanding towards Primary GMP on the topics of basic knowledge of Primary GMP, sanitation and hygienic operation, and GMP process obtained from multiple regression analysis (N = 44)

Note: p-value < 0.05, R = .52, R^2 = .28, F = 5.821

CONCLUSION AND DISCUSSION

The results disclosed that more than half of the respondents had fair overall knowledge and understanding of GMP. For management control for Primary GMP compliance, the results indicated a positive relationship between the premise-based audit and reputation. No negative indicators were found for public relations, housewife group's need, and product presentation, with a statistical significance level of 0.05. In addition, basic knowledge of Primary GMP and safe food production processes can explain the BHG's satisfaction with the Primary GMP. The results also proved that most operators in the BHG, Bangchang Community sample had a basic knowledge of Primary GMP as an essential quality assurance system for product safety, good manufacturing practices, hygienic requirements, and a two-year record or a report, and a product analysis.

Hypothesis testing

Hypothesis 1 expected that the factors of knowledge and understanding of Primary GMP consisting of sanitation and hygienic operations and safe food production processes may affect Primary GMP satisfaction. This hypothesis was proven by the multiple regression correlations and coefficient of determination. The testing proved that knowledge and understanding can describe a significant variance in satisfaction with Primary GMP. This means that most food operators in the BHG are satisfied with the Primary GMP (process, sanitation, and hygienic operations). Hence, in sum, those variables significantly affect the satisfaction of Primary GMP at the significance level 0.5. Eventually, the measured variables can explain knowledge and understanding of Primary GMP towards Primary GMP satisfaction. The results are consistent with Srisukanya (2005), who indicated that operators with good knowledge of GMP behave strictly according to the GMP guidelines at a significance level of .05. Moreover, the results are related to Pranee (2013); that study investigated whether the local product development process must have a knowledge building sponsorship by an organization. Alimentarius (1997) explained that knowledge and understanding of products and processes are essential to producing safe commodities.

Hypothesis 2 anticipated that management controls for Primary GMP compliance may affect sanitation and hygienic operations. This hypothesis was proven using the Pearson Product Moment Correlation Coefficient of the management controls for Primary GMP compliance and Primary GMP satisfaction. The results indicated a positive relationship on the premise-based audit and reputation. No negative relationship was found for public relations, housewife group's need, and product presentation with a statistical significance of 0.05. These tested results are consistent with Srisukanya (2005). That study proved that most employees participated in the ISO9000 version 2000 requirements; moreover, Dole Thailand HuaHin Limited employees' satisfaction towards GMP standards were at a high level. Additionally, the results are close to findings from Sahoo (2020) that joint operations, relationship management, and information provision encourage the success and capability of operating a food production manufacturing company.

Hypothesis 3 expects that knowledge and understanding of Primary GMP can describe the variance of Primary GMP knowledge on the topics of basic knowledge, sanitation and hygienic operation, and GMP Process. Multiple correlations prove this hypothesis. The results indicated

the majority in the BHG in Bangchang Community had a basic knowledge of Primary GMP as essential quality assurance of product safety, good manufacturing practice, hygienic requirements, and a two years-record or a report or a product analysis. The results close to Pranee (2013) that knowledge and understanding guide the operators for community product development towards the community product standard. Besides, the results coincide with Yodsuwan (2010) on promoting food production following GMP Codex. In addition to Srisamer (2018) the author proved that the manufacture interested in acquiring Primary GMP must follow-up the requirements, build knowledge and understanding, report processing and produce the quality products. Basil (2014) also describes that GMP is the main point for production, marketing, inventory and sale.

This research reflected that knowledge and understanding for Primary GMP of the BHG affects GMP satisfaction. The results indicated that the BHG respondents were satisfied with the Primary GMP on sanitation and hygienic operations and GMP processes. These variables can predict knowledge and understanding and Primary GMP satisfaction. For the management controls for Primary GMP compliance, the positive indicators showed on premise-based audit and reputation. No negative relationship was found for public relations, housewife group's need, and product presentation with a statistical significance of $p < 0.05$. Finally, the BHG study participants had knowledge and understanding of the Primary GMP as an essential quality assurance system for product safety, good manufacturing practices, hygienic requirements, a two-year record or a report, or a product analysis.

RECOMMENDATION

The research suggested that those companies or other local community enterprises interested in acquiring GMP certification should plan GMP training for their operators to facilitate new learners on the general knowledge and understanding of the GMP. Furthermore, the company should provide more comprehension on management controls for Primary GMP of Thailand for their employees because employees who understand the rules and practices will manufacture correctly, resulting in a quality finished product. According to the respondents' comment, they have a special requirement that it would be better to allocate the suitable location or premise or equipment for their Primary GMP production because current production has remained in a traditional process. Moreover, as recent work has been limited in some production areas, future work should examine the different production areas, such as a manufacturing of traditional medicines and other products in Samut Songkhram. It shall extend the capacity of the enterprise and promote local product value. Last but not least, as a whole, future research should emphasize knowledge and understanding of GMP of all local enterprises in Samut Songkhram. It would be better to analyse in a big picture.

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