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WILL THE RATINGS AND REVIEWS OF ONLINE DIETARY SUPPLEMENT SCREEN FOR UNSAFE PRODUCTS IN THE E-MARKETPLACE

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ABSTRACT

The dietary supplement market has been growing rapidly, resulting in an increased risk of consuming unsafe products. Therefore, it is important to separate unsafe products from available products. The objective of this cross-sectional study was to determine the relationship of ratings and reviews of online dietary supplement towards unsafe products. The lists of products from the health product contamination examination reports from 2016 to 2018 were applied as reference products. The available products in the e-marketplaces (LAZADA and Shopee) and their ratings and reviews between October to December 2019 have been collected and divided into 2 groups: safe and unsafe products according to reference products. Product rating was analysed by t-test whereas, product reviews were analyzed by Chi-square test, sentiment analysis, and Principal Component Analysis (PCA). Consequently, 46 products with 288 ratings and 496 reviews were analysed. The results showed that there was not statistically significant difference in product rating between safe and unsafe products (p-value = 0.471). The reviews were classified based on marketing mix (product, price, place, and promotion) and polarity (positive, neutral, and negative). The reviews related to product and price components in the unsafe product group were higher than the other group. The proportion of negative reviews in the unsafe product group was higher than the other group. The result was found that product reviews of safe and unsafe product groups cannot be separated. In conclusion, there was no relationship between consumer opinions and unsafe online dietary supplements. Therefore, the consideration of product ratings and product reviews might not be able to use to screen unsafe products from any available products in the e-marketplaces.

Keywords: consumer opinion, dietary supplement, e-marketplace

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Introduction

Technology has influenced people's lifestyles and has made changes in the business context.[1] The use of technology among Thais was displayed as the spending times in using the Internet, which is over ten hours a day according to the 2020 Thailand Internet user behavior report by the Electronic Transactions Development Agency (EDTA).[2] The online market is expanding rapidly. The market value of dietary supplements in Thailand potentially reaches sixty-nine billion baht by 2020.[3] The growth of the dietary supplement online market increases the risks for consumers' health as well. Those risks were evidenced by consumer complaints and surveillance data on the dangers of consuming dietary supplements. The number of complaints from the Complaint and Suppression Center for Health Products, the Food and Drug Administration, the Ministry of Public Health, Thailand about dietary supplements has been steadily increasing over the years.[4,5] In 2020, there were 1,506 complaints related to dietary supplements, which accounted for a third of all complaints. More than half of the complaints involved health products sourced online.[6] Although the Food and Drug Administration, Ministry of Public Health issues more than 30 warnings about dietary supplements through various media every year,[7] the dangers of consuming dietary supplements are increasing unprompted to stop. In 2020, the Bureau of Quality and Safety of Food, Department of Medical Sciences reported that of 919 dietary supplements, 121 (13.17%) products were adulterated by the addition of pharmaceutical substances, for instance, dexamethasone, sibutramine, sildenafil, etc.[8] Besides, the problem of illegal dietary supplements and dietary supplements containing pharmaceutical substances are other points that affect consumer safety. A study in Loei, Thailand found that 48.98% of dietary supplements were unspecified or incorrectly identified of the food serial number.[9] Therefore, consumers have to choose the product carefully for safety. There are a variety of factors that affect consumption decisions such as product information, package, price, and promotion.[10] Currently, product information is not only provided from the sellers but also provided from other consumer opinions. Consumers use information from other consumers for their decision to consumption. In the context of online marketing, consumer opinions are expressed as product ratings and product reviews.[11] It is doubtful the consumer opinions can help another consumers select the safe product. Therefore, this study aimed to determine the relationship of ratings and reviews of online dietary supplement towards unsafe products.

Materials and methods

This study design was a cross-sectional observational study. The health product contamination examination reports from 2016 to 2018 by the Department of Medical Sciences, Ministry of Public Health have been used as a reference in this study.[12-14] The reports showed the results of product contamination, which were divided into 2 groups. A group that found dangerous substances represented as unsafe product group. The other had no contaminated substances represented as safe product group.

Data collection

Dietary supplements available online in the e-marketplaces (LAZADA and Shopee) during October to December 2019 were determined. Inclusion criteria of study samples were 1) the dietary supplement contained product ratings and reviews during October to December 2019, and 2) there was a product contamination result according to the health product contamination report mentioned previously. Finally, 46 dietary supplements with 288 ratings and 496 reviews were recruited. Product rating provided a score from 1 (minimum score) to 5 (maximum score) to each product.

Product review provided consumer opinions toward each product. Product reviews were classified according to the market mix including product, price,

place, and promotion components[15] and classified into polarity of opinions. For marketing mix components, a product component is a group of reviews related to dietary supplement products in various fields such as product characteristics, result and adverse effect of using a product, and continuous use of product. A price component is a group of reviews related to all the expenses that consumers have to spend in consuming products such as product price, value of product, and shipping cost. A place component is a group of reviews related to the ease of accessing products and delivery of products by sellers. A promotion component is a group of reviews related to activities or benefits available to consumers to promote the sale. For polarity, it is a trend of pattern used to consider an opinion, which consists of positive, neutral, and negative polarity.[16] The marketing mix component and polarity value classification were separately conducted by two persons. If both opinions were inconsistent, the third expert's opinion was used for consideration.

Data analysis

Data analysis was conducted in 2 parts according to the data type, which was product ratings and product reviews. Product ratings were analyzed using t-test. Product reviews were analyzed using Chi-square test, manual sentiment analysis, and Principal Component Analysis (PCA).

Manual sentiment analysis is the tendency analysis of opinions towards something by summarizing the opinions of individuals manually. PCA is a data analysis technique often used for complex data. This method has the ability to identify variables that are important to a particular feature of a data set. In which the characteristics of the data are not neglected during analysis.[17,18]

Each review was considered to identify the marketing mix component and also determined the polarity by manual sentiment analysis. After that, PCA technique with Waikato Environment for Knowledge Analysis (WEKA) software was used to analyze the data. The distribution of points representing each component on the principal component plot was considered to determine whether the marketing mix component with polarity can be used to separate product groups.

The statistical analysis programs used in the study were the PSPP under the GNU general public license and the WEKA version 3.8.3. Both of them are free software.

Results

Characteristics of analyzed products

Dietary supplements can be divided into three categories by purpose of use including beauty products, health care products, and sexual health products. The numbers of safe and unsafe products classified according to their intended use are shown in Table 1.

Beauty products were found in the highest proportion. Health care products were found the same proportions in safe and unsafe product groups, while sexual health products were found higher in the unsafe product group than the other.

Pharmaceutical substances found in unsafe products for beauty purposes were sibutramine, fluoxetine, fenfluramine, and orlistat. These substances have an effect on weight loss. Unsafe products used for health care were often adulterated

Table 1 Analyzed products classified by the purpose of use

Purpose of use	Safe product group (N=23)	Unsafe product group (N=23)
Product for beauty	20	16
Product for health care	2	2
Product for sexual health	1	5

with steroids or pain relievers, such as dexamethasone, diclofenac, and paracetamol. Unsafe products used for sexual health were adulterated with one or more sex enhancers including sildenafil, tadalafil, or vardenafil.

Product rating

Of 23 products, 109 ratings, the average rating score of the safe product group was 4.53 (SD = 1.05). The other 23 products and 179 ratings in the unsafe product group showed average rating scores of 4.43 (SD = 1.23).

The difference in product rating scores between safe and unsafe product groups was not significantly different with a *p*-value of 0.471.

Product reviews

Of all 496 reviews, there were 193 and 261 reviews from safe and unsafe product groups classified by marketing mix component, whereas 42 reviews were not identified.

The numbers of product reviews classified by marketing mix component are shown in Figure 1. There was a statistically significant difference between product group and marketing mix component, the *p*-value was less than 0.01 at 95% confidence interval. The reviews toward product component included product characteristics, results and adverse effects of using the product, and continuous use of product.

Product reviews classified by polarity of safe and unsafe products are shown in Figure 2. There was a statistically significant difference between product group and polarity, the *p*-value was 0.01 at 95% confidence interval.

Consumer reviews divided according to marketing mix and polarity are shown in Table 2. The polarity trends of all components in both product groups were not different. The positive polarity had a large proportion, which accounted for over two-thirds of all components. Except for the promotion component of the unsafe product group, which did not find any reviews. The negative reviews were found in the second rank of the product component from both groups. While neutral reviews were found in the second rank of the place component from both groups as well.

Considering marketing mix and polarity to separate consumer opinions between safe and unsafe products were analyzed using PCA. The principal component plot generated from WEKA is shown in Figure 3. This diagram presents the distribution of points representing components of both product groups. The green dots represent the safe products and the red dots represent the unsafe products.

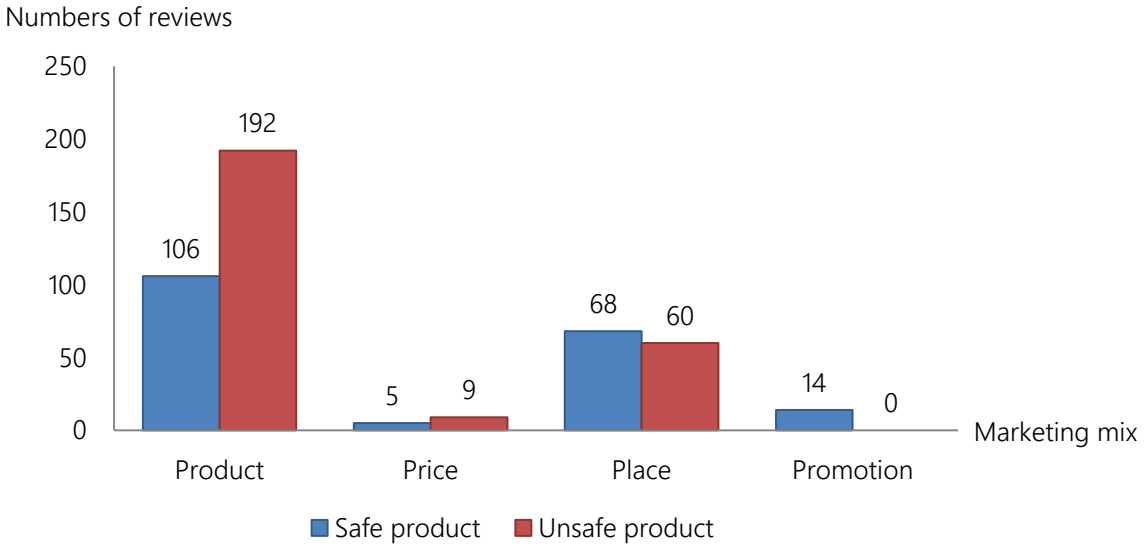

Figure 1 The numbers of product reviews classified by marketing mix

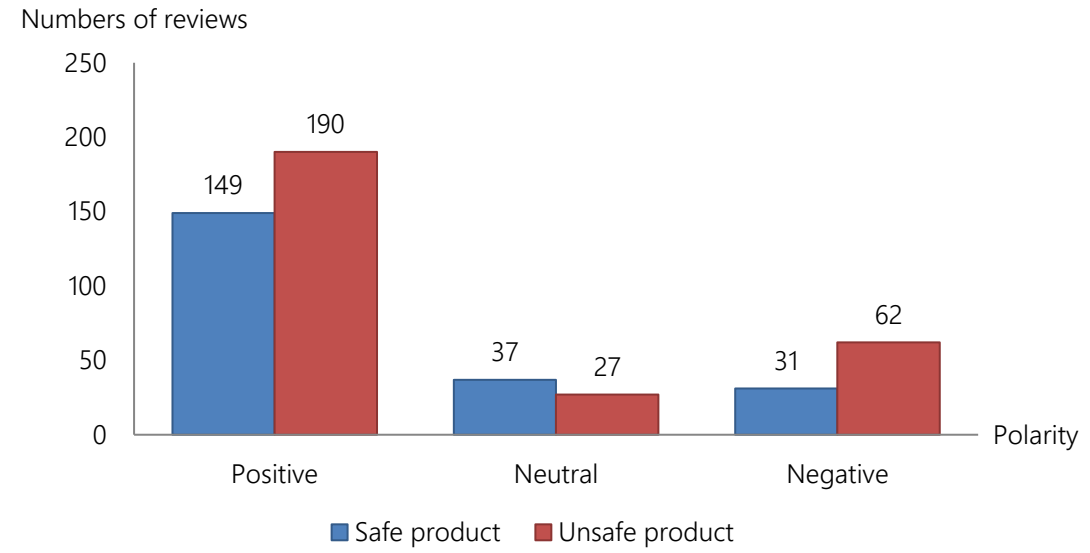

Figure 2 The numbers of product reviews classified by polarity

Table 2 The proportion of polarity in each group of the marketing mix

Marketing mix	Safe product group			Unsafe product group		
	Positive	Neutral	Negative	Positive	Neutral	Negative
Product	76.4%	3.8%	19.8%	66.6%	2.1%	31.3%
Price	80.0%	0.0%	20.0%	100.0%	0.0%	0.0%
Place	67.7%	23.5%	8.8%	85.0%	11.7%	3.3%
Promotion	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%

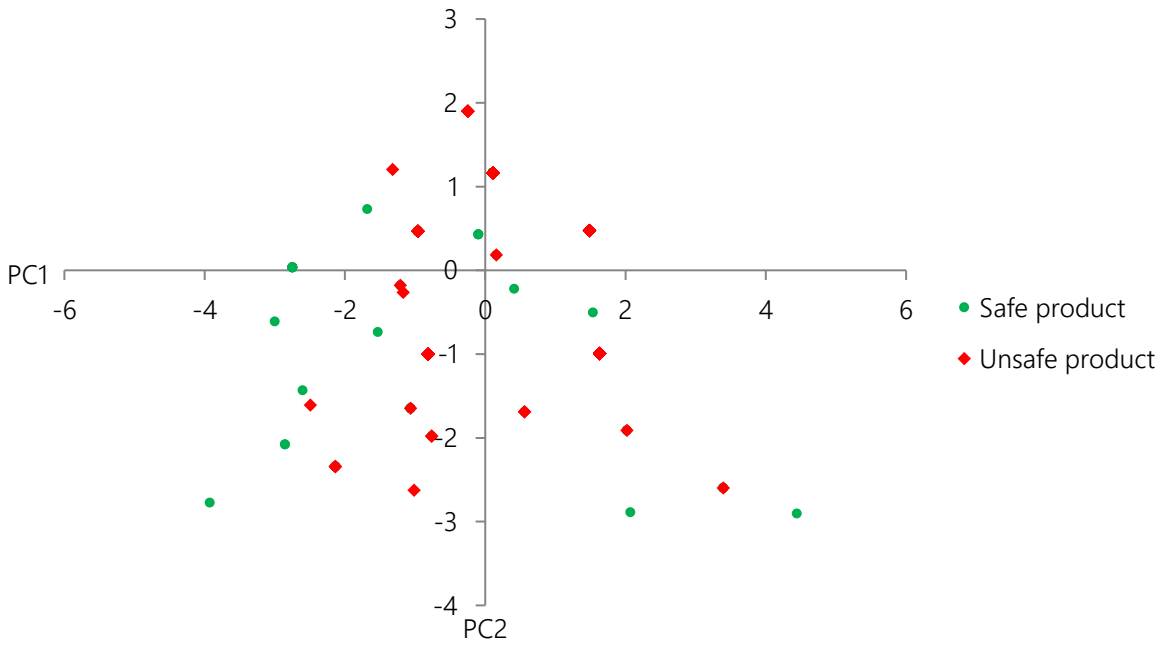

Figure 3 Principal component plot

The distribution of two colored dots from the principal component plot cannot be separated. The product reviews of both product groups considering by marketing mix and polarity were inseparable by PCA. Therefore, consumer opinions toward safe and unsafe dietary supplement consumption were not different.

Discussion

Dietary supplements for beauty were the most popular products found in online market which consistent with other studies[19,20] because trend of consumer behaviour concerns in body shape and beauty. The number of safe and unsafe products were not different in beauty products. This proportion of unsafe products should be aware by state authorities and consumers. The unsafe product can provide adverse effects of pharmaceutical substances adulteration to consumers, although the Food and Drug Administration announces warnings of beauty product consumption, the unsafe products are mostly available in the online market.

In online marketing, consumer opinions were expressed from product ratings and product reviews. The product rating showed how satisfied consumers were with consuming that particular dietary supplement. The ratings towards safe and unsafe product groups were not significantly different. It demonstrated that consumers had no difference in satisfaction with the two product groups. Product rating was not correlated with the identification of unsafe products and could not be considered as separate criteria for dietary supplements.

Consumer opinions toward online dietary supplements showed that the product component was the most reviewed based on the marketing mix component. The other most reviews were place, price, and promotion components respectively. The results in this section were consistent with Wilailuk's study indicating the order of components that matched.[21] It also had a conclusion consistent with the study by Anusara[22] that presented the product component was the most important to a consumer for choosing a dietary supplement.

Consumers paid great attention to the expected results from using products that correlated with the study results of Sirikanlaya.[23] Factors that promote consumer satisfaction included providing great shipping services and allowing consumers to choose satisfactory shipping service providers. Product reviews related to the promotion component were rarely encountered during the data collection. It may reflect that promotion was not an interesting component for consumers.

The product reviews based on marketing mix and polarity were analyzed using PCA. The results revealed that consumer opinions toward unsafe dietary supplement consumption were no different from those of the safe product group. Therefore, product reviews were not related with the identification of unsafe products as well.

The findings of this study showed that reviews could not reflect safe products. There are several reasons explaining this issue. Firstly, consumers spend a long time to get adverse events from an unsafe product, while they review shortly after using the products. Secondly, reviews and comments are marketing tools in the e-marketplace system. Since there was a study indicated that online product reviews influence consumers' decision making.[24] Some reviews may not reflect safe products. Thirdly, consumers rarely responded to adverse events associated with unsafe products. According to Chiba's study in Japan, the findings revealed that only 1.4% of consumers complained to the retail store and 5.4% complained to the manufacturer.[25] Lastly, consumer reviews may unclear to support the identification of safe products.[26]

According to the study of Chawan and Preecha states that getting appropriate information can influence consumers' decisions to consume dietary supplements safely.[27] Therefore, the findings from this study increased awareness of consumers towards decision making to dietary supplement

consumption because information from other consumers did not reflect the safe product. According to Parichat's study, consumers' correct perception of risks and value of dietary supplements enhances the safety of their dietary supplement consumption.[28] Therefore, developing consumer knowledge to make safe decisions of dietary supplement consumption is important.

The limitation of the study was the researchers could not conduct adulteration tests for all dietary supplements available online. Therefore, the samples were selected according to the health product contamination examination reports from 2016 to 2018 as a reference, which may not cover all available dietary supplements in Thailand. However, the results revealed that some products were reported illegal pharmaceutical substance adulteration and should be withdrawn from the market but they were still sold online in 2019. The consumer opinions toward dietary supplements are beneficial for post-marketing control. There is also proactively searching for consumption problems to create a safe system for dietary supplements. The further study should be considered this limitation and applied the current health product contamination examination reports as a reference or test the adulteration of all recruited products in order to provide more comprehensive conclusion.

Conclusion

This study summarized opinions related to dietary supplement consumption online among Thai consumers by product ratings and reviews. We found that the ratings for products in the safe and unsafe groups were not different. The reviews based on marketing mix and polarity from both product groups were also the same. There was no relationship between consumer opinions and unsafe online dietary supplements. Therefore, considerations of product ratings and reviews indicate the trend of other consumer opinions about the dietary supplement but cannot be used to screen unsafe products. It is imperative that consumers should carefully consider all dietary supplement information to make safe consumption decisions.

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Conflict of Interest

We would like to declare that there are no conflicts of interest related to the work.

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