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The effects of emotional eating and negative framing on healthy food choices: a quasi-experimental study on college student participants using virtual reality

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ABSTRACT

Cases of obesity have increased significantly in recent years, triggering the risk of chronic diseases such as cardiovascular disease, diabetes, depression and cancer. One of the main factors is unhealthy food choices, so further research is needed to understand the factors that influence food preferences. This study aimed to evaluate the influence of emotional eating and negatively framed messages on healthy food choices, using a quasi-experiment method involving 135 participants. Data were analyzed using general linear models to identify significant patterns of relationships. The results showed that negatively framed messages had a significant influence on healthy food choices, although the effect was not very strong. In contrast, emotional eating showed no significant influence on healthy food choices. However, there was an interaction between negative framing and emotional eating that influenced healthy food choices, suggesting that individuals with emotional eating tendencies may respond differently to negatively framed messages compared to other individuals. This study highlights the importance of message-based approaches to promote healthier eating habits. The practical implications of the findings may provide guidance for designers of public health interventions to consider aspects of message framing as one of the strategies in health campaigns. Further research is recommended to explore additional factors, such as mood, body mass index, gender, emotion regulation, and individual food preferences during emotional eating. These results may contribute to the design of more effective health policies in reducing the prevalence of obesity and motivating people to make healthier food choices.

Keywords:

Emotional eating
Negative framing
Food choice
Eating behavior

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Introduction

In recent decades, overweight or obesity has experienced a significant increase in prevalence (Li et al., 2019). It was proved that in the period from 1975 to 2016, obesity cases which were initially 4% increased to 18%, and at least almost 2.8 million people died each year (WHO, 2021). The negative impacts caused were an increased risk of chronic diseases; such as, cardiovascular, diabetes, depression, and cancer (Li et al., 2019). There are several factors which cause obesity, one of which is unhealthy food choices (Kurdanti et al., 2015; Rifai Ali, 2018). Therefore, individuals need to maintain their food choices in order to avoid the risk of obesity. Personal factors, such as emotional eating styles, are believed to have an influence on a person's food preferences (Sobal & Bisogni, 2009). It is

because of the influence of control over a person's tendencies when faced with food cues (Janssen et al., 2017). Moreover, emotional eating is a condition where individuals eat not to satisfy hunger but to overcome negative emotions such as, anxiety and anger by diverting them to food and considering them as rewards (Godet et al., 2022; Nurdiani et al., 2023). In addition, the food consumed tends to contain excessive amounts of sugar, salt, and fat (Andarwulan et al., 2021) so that it influences unhealthy eating patterns (Zahrah et al., 2023).

In addition to emotional eating style, there are other factors which are thought to influence individuals in choosing food, namely health messages which are strategies to promote health messages by forming desired behavior (Northcott et al., 2024). Furthermore, based on the formulation method, health messages are divided into two forms, namely positive framing and negative framing (Levin et al., 1998), where positive framing is a positive consequence for conducting the recommended action which is emphasized while negative framing is a negative consequence if not conducting the recommended action that is emphasized (Van Assema et al., 2001). Negative framing is considered to have a higher persuasive effect since individuals tend to avoid the risk of loss to themselves (Kai-Ineman & Tversky, 1979) which is proved by research which had been conducted by (Thrasher et al., 2015) which showed that smoking cessation messages using negative framing have a fear effect on smokers so that it increases their intention to quit smoking. However, several studies have found that positive framing messages are more persuasive and more effective in increasing consumer purchasing intentions for environmentally friendly products (Segev et al., 2015; Van de Velde et al., 2010). The use of negative framing in food choices in the 18-24 year old student population needs to be studied in more depth. This age group is often the target of marketing strategies as they are at a transitional stage towards independence, including in decision-making related to food consumption. In this group, eating behavior is often influenced by emotional and social factors, so negative framing can be an effective tool to motivate them to avoid unhealthy foods.

To the best of the researcher's knowledge, research on emotional eating and negative health cues framing on food choice is still very minimal since so far research on the effect of emotional eating has only focused on obesity (Baños et al., 2014; Braet et al., 2008; Dakanalis et al., 2023; van Strien et al., 2012), while research on framing mostly focuses on the field of advertising and product sales (Garg et al., 2021; Kusumasondjaja, 2018), as well as the interaction between the two and the inconsistency of research results regarding the effectiveness of using positive framing and negative framing. The lack of studies integrating these two variables suggests a research gap that needs to be filled. In addition, research results related to the effectiveness of using both positive and negative framing are often inconsistent, thus requiring further testing. Furthermore, most previous studies have been conducted in western countries. This strengthens the researcher's rationale for conducting a study using negative health cue framing in Indonesian society, which has a different eating culture and population characteristics. Indonesian cultural aspects are important to consider, especially as Indonesian diets are heavily influenced by social, traditional and food availability factors. For example, high-carbohydrate foods such as rice are a major component in almost every meal, and the custom of eating with family or friends is often a significant social moment. These factors can influence how individuals respond to framing-based interventions, including negative framing. In addition, Indonesia has unique health challenges related to diet, such as the increasing prevalence of obesity and non-communicable diseases due to unhealthy food consumption. This makes research exploring the effectiveness of negative framing in encouraging healthier food choices particularly relevant. In addition, the measurement methods in previous studies mostly used laboratory-based experiments, observations, filling out questionnaires which researchers considered still less effective and tended to have a faking good bias. Virtual reality can be used as a means to measure eating behavior with more credible results and high validity (Xu et al., 2021) and this study used a quasi-experimental study approach. In addition, the costs required for operation are not too expensive and require much fewer resources compared to conducting direct experiments in supermarkets. Several previous testing studies have used virtual reality to study aspects of eating behavior; such as, to understand food selection at buffets (Persky et al., 2018) and the amount of food served (Isgin-Atici

et al., 2020) as a useful method in order to educate individuals about portion sizes in virtual cafeterias, but there is still minimal research in the supermarket environment.

This study aims to explore the influence of emotional eating styles and negative framing on food choices, with the hope that the results can support the creation of more effective health policies in society. The focus of this research is closely related to the previously identified issue of the increasing prevalence of obesity and its impact on public health. Through a deeper understanding of how emotional eating styles and message framing influence food preferences, this research seeks to make a significant contribution to designing intervention strategies that can help consumers avoid unhealthy foods (Shan et al., 2020) while promoting healthier food choice habits. Thus, the hypothesis of this study is that there is an effect of emotional eating style and negative framing on food choice. The combination of these two variables was deemed important to study together, with the aim of the study seeking to explain in greater depth how psychological factors and communication strategies can interact to influence food preferences. This understanding is important to support efforts to create more effective interventions to encourage healthy food choices, both at the individual and societal levels.

Methods

The research design used is a quasi-experiment. From the research design, it can be seen that this study consists of 2 groups, namely the experimental group and the control group, each group consisting of at least 67 people. The choice of quasi-experimental design is based on the consideration that this approach helps researchers to explore the effects of interventions in conditions that are closer to the real world, although without full control of external variables as found in full experimental designs. The population of this study is students of public universities in Indonesia with the age range of 18-24 years. Sampling was conducted using purposive sampling technique, which was chosen because the focus of the study was on the student population with specific criteria. The inclusion criteria of the participants were students of public universities in Indonesia with the age range of 18-24 years old, who did not have restrictions in food selection (e.g. vegan, certain diets, or food allergies). To ensure the accuracy of these criteria, participants were interviewed before taking part in the study.

Data collection was conducted at the Laboratory of the Psychology Study Program at Semarang State University in August 2024. Participants who were willing to participate filled out informed consent and The Dutch Eating Behavior Questionnaire (DEBQ) questionnaire through Google Form. The measuring instrument in this study is a virtual reality supermarket, which has the validity to measure food selection behavior (Waterlander et al., 2015), and has been designed in such a way that participants can interact and feel a real shopping experience. Meanwhile, The Dutch Eating Behavior Questionnaire (DEBQ) is an eating behavior questionnaire consisting of 33 items developed by (Van Strien et al., 1986). Data analysis was conducted using the generalized linear model (GLM), which was chosen for its flexibility in analyzing the relationship between independent and dependent variables in various data scales. Testing was conducted with SPSS Statistics software version 25.0, using parameters such as effect size ($d = 0.15$), significance level ($\alpha = 0.05$), and test power (power = 0.95) (Lemeshow et al., 1997). The statistical assumptions of the model, such as linearity and data independence, were checked to ensure the validity of the results. Interpretation of the results was based not only on statistical significance, but also on their practical relevance in the context of public health promotion.

The research procedure involved experimental sessions that included simulated shopping, calculation of shopping results, and a final interview to provide an overview of the research objectives. Each session was designed to be of sufficient duration so that participants did not experience significant fatigue or discomfort. In addition, participants' rights were protected through strict ethical guidelines, including protection against potential side effects of using virtual reality,

such as visual discomfort or nausea. This study has obtained ethical approval from the Semarang State University Health Research Ethics Commission with number 394/KEPK/FK/KLE/2024.

Results and Discussion

Tabel 1. Descriptive Statistics

Group	n	Mean	SD
Experiment	68	61.6747	17.16590
Control	67	62.3266	17.07718
Total	135	61.9982	17.06106

The descriptive statistical data above shows that Healthy Food Choice for the experimental group ($M = 61.6747$, $SD = 17.16590$, $n = 68$) while for the control group ($M = 62.3266$, $SD = 17.07718$, $N = 67$). Overall, ($M = 61.9982$, $SD = 17.06106$, $N = 135$). It shows that the mean of the control group is greater than the negative framing experimental group. However, the standard deviation in the experimental group is higher than the control group which indicates that the variation between healthy food choice values in the experimental group tends to be quite large. Meanwhile, the almost the same standard deviation between the experimental and control groups indicates a difference which is not large enough to be considered statistically significant.

Table 2. Univariate General Linear Model Analysis

Variable	Sig	Partial Eta Squared	B
Negative Framing	.046	.030	18.511
Emotional Eating	.772	.001	.246
Negative Framing*Emotional Eating	.030	.036	-.566

Based on the table above, the analysis results show that negative framing has a significant influence on healthy food choices, with a p value = 0.046 and a partial eta square (η^2) of 0.30. The p value which is smaller than 0.05 indicates that the effect of negative framing on healthy food choices does not occur by chance. Meanwhile, the partial eta squared (η^2) value of 0.30 indicates that negative framing exerts a fairly strong influence in explaining variations in healthy food choices. In contrast, emotional eating had no significant influence on healthy food choices, with a p value = 0.772 and a partial eta squared (η^2) of 0.01. The p value being much greater than 0.05 indicates that the relationship between emotional eating and healthy food choices is not strong enough to be considered statistically significant. In addition, the η^2 value of 0.01 indicates that the contribution of emotional eating to variations in healthy food choices is very small, almost negligible.

Then, the interaction between negative framing and emotional eating has a significant effect on healthy food choice with a p value = 0.030, a partial eta square (η^2) of 0.30, and a regression coefficient (B) of -0.566. A p value smaller than 0.05 indicates that this interaction does not occur by chance, while the η^2 value of 0.30 indicates that the interaction has a considerable contribution in explaining variations in healthy food choices. The negative regression coefficient ($B = -0.566$) indicates the direction of the relationship, i.e. the lower the level of emotional eating, the greater the influence of negative framing on the decision to choose healthy food.

Discussion

The results of this study show that the hypothesis which states that there is an effect of emotional eating style and negative health cues framing on healthier food choice is accepted. The interaction between emotional eating style and negative health cues framing significantly affects healthier food choice. Evidence shows that emotional eating style and negative health cues framing together have a negative influence on healthier food choice with an effect size, partial $\eta^2 = .036$. Therefore, it means that individuals who have a low emotional eating style are then given exposure to negative health cues framing are able to influence their food choice decisions to be healthier. Meanwhile, for

individuals who have a high emotional eating style are then given exposure to negative health cues framing will affect their food choice decisions towards unhealthy. This study found that giving negative health cues framing has significant results on healthier food choices which occurs because of the cognitive assessment of the situation or threat message that emphasizes the health risks of unhealthy foods so that individuals avoid and choose healthier food options (Dunn & Schweitzer, 2005; Loro, 2007; Rothman & Salovey, 1997; Shan et al., 2020; Slovic et al., 2007). When thinking, individuals will predict the losses they might receive as a result negative emotions in the form of fear will arise and then direct individuals to form behaviors in order to avoid risk or loss by choosing healthier foods (Kim et al., 2022; Naeem, 2021). Fear is a negative emotion accompanied by a high level of arousal, triggered by threats which are considered important and individually relevant (LeDoux, 2014). It affects the decision-making process (Öhman & Mineka, 2001), including psychological changes in customer behavior (Naeem, 2021). Based on the results of study which had been conducted by (Yıldırım & Güler, 2022), it shows that the greater the loss predicted by the cognitive process due to negative framing, the greater the behavior of avoiding losses (Tannenbaum et al., 2015), who stated that the appeal will be more effective in instilling fear if it is conveyed by emphasizing the severity or loss which may be received. It proves that negative framing is an effective step in eliciting healthy food choice behavior.

In addition, giving negative health cues framing to individuals with a low emotional eating style type actually decreases their appetite as negative emotions increase; especially, fear due to warnings so that they choose healthier foods. On the other hand, in individuals with a high emotional eating type, negative framing actually increases their appetite in response to negative emotions; such as, stress, resulting in increased consumption of unhealthy foods since they contain high fat and sugar (Macht, 2008). These results are supported by research which had been conducted by (Van Strien et al., 1986) that individuals with low emotional eating types tend to have more controlled and regular eating patterns and choose healthier foods after experiencing negative emotions. It confirms the relationship between low emotional eating and responses to negative framing, namely raising alertness and negative emotions; such as, fear and anxiety. (Shehryar & Hunt, 2005) stated that the frightening impression that is trying to be conveyed in various advertisements can raise negative emotions; such as, anxiety, rejection or avoidance of unwanted behavior. Other studies have also shown that negative framing can increase healthy food choices; such as, fruits and vegetables, in (Gerend & Maner, 2011). In addition, Christoforou, et al. (2018) found that negative framing presented by using an obesity model accompanied by text messages caused fear in participants and influenced them to choose healthier food options.

Meanwhile, individuals with emotional eating types without being given negative framing are less effective in increasing healthier food choices since basically individuals have the motivation to survive when faced with fear of threats to their health (Gerend & Maner, 2011). Without threats and fear, individuals with emotional eating types consume food without thinking first because of low awareness when eating (Somov, 2015). This results in these individuals being unwise in choosing food and eating excessive portions. It is in line with the results of research (Wansink & Sobal, 2007) where individuals overeat and experience weight gain since they are not aware of the many food decisions, they make every day. In addition, the food that is generally consumed is unhealthy food for the body (Salsabiela & Putra, 2022). Therefore, emotional eating is less effective in increasing healthier food choices.

Conclusion

The conclusion of this study confirms that negatively framed messages have an influence on healthy food choices, but the effect is not significant when applied to individuals with emotional eating styles. The findings suggest the potential for message framing strategies to be widely used in healthy food promotion campaigns, including in food advertising in supermarkets. For practical applications, the results of this study can provide guidance for policy makers, social workers, and activists focusing on public health in designing more effective communication strategies. For example, message framing

can be integrated into health interventions designed to encourage healthier eating behaviors, especially in retail environments such as supermarkets.

However, this study also has limitations, mainly related to the use of virtual reality, where the design of the virtual supermarket system is time-consuming and may not fully reflect real-world conditions. In addition, generalization of these findings should be done with caution, given limitations such as the limited sample population and the virtual setting that may influence food decisions differently than the real environment. Thus, future research is expected to improve the virtual supermarket system and processes to increase efficiency, as well as explore more deeply other factors that influence food choices. Factors such as mood, body mass index, gender, emotion regulation, coping strategies and food preferences during periods of emotional eating need to be further investigated to provide a more holistic and in-depth understanding.

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