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Research Paper

Emotional Eating and Stress in College Students: A Meta-Analysis Study

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Abstract

This study fills a knowledge gap regarding the relationship between emotional eating and stress in college students, which has not received adequate attention and there have not been many studies that examine the relationship between these two variables in the context of college students. Stress that cannot be managed properly will lead to emotional eating behavior, which, in the future, can have both physical and mental effects on the sufferer; therefore, this research is needed. This study aimed to determine the effect of emotional eating on stress and to detect variations among studies using meta-analysis techniques. This study hypothesizes that there is a significant relationship between emotional eating and stress in university students. This study analyzed 9 primary studies using the keywords "emotional eating, stress, college" and "emotional eating, stress, adolescent" involving a total sample of n=3005 published in various journals and selected based on specific eligibility criteria. The analysis was conducted using VOSviewer to determine the distribution of publication variables and the PRISMA flow for reviewing the articles obtained in 9 studies. The meta-analysis was conducted using JASP software. The heterogeneity test results showed that the 9 studies were heterogeneous with a p-value <0.001; Q = 27,351. The mean effect size analysis results revealed a significant positive correlation between emotional eating and stress of 0.274 and included in the low category. The results of this meta-analysis are reliable because there is no publication bias and the results can be scientifically validated. This study has several limitations. First, there were only 9 studies analyzed, so the data obtained could have been more extensive. Second, changes in eating patterns based on emotions and responses to stress vary with time and geographical location. Meta-analyses include studies from different times or places that face difficulties in consistently evaluating changes.

Keywords *emotional eating; stress; college; students; meta analysis*

INTRODUCTION

Stress is a common problem affecting individuals of all ages. The advancement of technology and intense competition in modern life have led to the emergence of many stressors. Stress, as defined by the World Health Organization (WHO), is a condition of anxiety or psychological strain resulting from a challenging circumstance. Stress is an innate reaction that motivates individuals to confront and conquer obstacles and hazards. Regarding terminology, stress is defined as a physiological or psychological reaction to either internal or external stressors by the American Psychological Association. Stress causes modifications in nearly every bodily system, which affects how people feel and act. Each person experiences varying levels of stress. Likewise, general health is greatly influenced by one's response to that stress. According to the 2021 Garmin poll findings, Indonesia has the highest stress level in Asia, with the Philippines and Malaysia following closely behind. Stress can have both positive and negative effects. A positive impact can occur when the pressure does not exceed their stress tolerance or does not exceed their capacity and ability. Conversely, the negative impact of stress can occur when the perceived pressure exceeds the stress tolerance and exceeds one's capacity and ability. If it continues to occur, the stress that arises in individuals will have negative impacts if not appropriately managed. One individual who is prone to stress is students.

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Students face academic burdens, environmental changes, and heavier social pressures than at previous levels, making them vulnerable to stress. According to the findings of earlier studies, students who are writing theses have an academic stress level that falls into the high category of academic stress (46.9%). A number of causes, including self-imposed stress, frustration, conflict, pressure, opportunity, psychological, emotional, behavioral, and cognitive aspects, contribute to these students' high levels of stress (Ramanda & Sagita, 2020). Stress arises in response to stimuli known as stressors, which encompass physical, psychological, and physiological dimensions. Physical stressors can occur due to hot or cold temperature, an atmosphere that is too noisy, or an atmosphere that is too bright. Meanwhile, psychological stressors occur because of personal, social, cultural, and religious turmoil. Physiological stressors are caused by abnormalities in physical functions, such as organ structure and tissue function, and systemic diseases (Ginata et al., 2023). In addition, several factors contribute to the stress experienced by students. According to Davidson (1987) sources of stress include monotonous situations, overwhelming tasks, noise, obscurity, lack of control, not being appreciated, being ignored, confusing rules, conflicting demands, and coursework deadlines. These sources of stress, if not appropriately managed, will hurt students, as explained by field data conducted by Ambarwati et al. (2019), which explains that the tendency of stress in students has a negative impact, one of which is experiencing a delay in passing lectures so that they do not graduate on time. Stress that cannot be managed properly can have negative impacts on students' daily lives, especially their academic lives; therefore, it is important to have good stress management in each individual to prevent or reduce the negative impacts caused.

These negative impacts will undoubtedly cause harm to students, so managing the stress experienced is crucial. The impacts of stress range from mild, such as headaches, to fatal impacts, such as suicide. In addition to these adverse effects, stress can cause emotional eating in students, which is characterized by a consistent increase in food consumption. One aspect that is interesting to investigate is how stress in the college environment can trigger students' tendency to cope with perceived emotions through eating. In first-year students, the source of stress is usually due to adaptation to the new environment and learning system, while in the next-level students, the source of stress usually occurs due to increasingly heavy academic assignments and loads, while in final-year students, the source of stress comes from final assignments and the burden of future graduation. It is essential because academic challenges, competition, and significant lifestyle changes often lead to emotional eating, affecting physical health and academic performance, well-being, and overall quality of life. Therefore, efforts to identify and address stress and emotional eating tendencies are key to improving students' well-being and ensuring their academic success.

Moving to a university is one of the most stressful events due to significant life changes. As a result, emotional eating is more likely to occur because of increased stress, perceived stress, and a limited repertoire of adaptive coping mechanisms (Yilmazturk et al., 2022). Individuals engage in emotional eating to utilize their eating behavior as a coping method to relieve negative emotions or anxiety-provoking situations (Güner & Aydın, 2022). This category includes students with many study burdens and dependents that sometimes cause stressors from both internal and external conditions. These activities are carried out not because they are hungry but are used for transitioning to feel comfort, relieve stress, and improve one's mood and reward themselves (Trimawati & Wakhid, 2018). These issues, if not managed properly, will have a negative impact on physical health, such as weight gain and other diseases. Therefore, it is important to learn how emotional eating, which acts as a coping mechanism, can reduce stress but not disturb the body's health. The relationship between emotional eating and stress is a two-way relationship. Emotional eating can also contribute to increased stress levels. Feeling guilt or regret after overeating can increase one's stress levels, creating a repetitive cycle of stress and emotional eating that is difficult to break.

College students are more prone to having a messy eating pattern than other groups because of several factors such as irregular schedules, numerous tasks and activities outside the classroom, and extracurricular activities, which make it difficult to eat on time and obtain appropriate intake. In addition, financial limitations also cause students to have a messy eating pattern because they believe that it is better to eat filling than healthy (Pathan, 2023). In addition, access to healthy food is also difficult to obtain around college campuses, especially for those who live in dormitories and have strict cooking rules. This condition makes students more vulnerable to stress, which can ultimately lead to unhealthy eating habits. Emotional eating that is not managed well in the future will cause several consequences, such as overweight, depression, anxiety, unhealthy eating behavior, decreased brain function, reduced ability to move, insulin resistance, worsened sleep quality, digestive disorders, obesity, and mood problems (Dakanalis et al., 2023; McLaughlin, 2014). In addition to some of the aforementioned impacts, emotional eating affects increasing fast food consumption. Previous studies have found that students who experience emotional eating consume unhealthy foods and high-calorie foods. Therefore, it is important for students who experience emotional eating disorders to overcome it with a healthy diet (Bennett et al., 2013). This is in line with research conducted by Ramadhani and Mahmudiono (2021) that emotional eating is positively correlated with the consumption of fast food or canned food, sweet foods or cakes, dairy products, and sweet drinks. These findings indicate that emotional eating plays an important role in individuals' coping mechanisms when experiencing stress. This is in accordance with affecting theory, which states that increased food consumption in response to negative emotions can serve as a coping strategy that can temporarily relieve negative mood (Canetti et al., 2002).

Previous research has examined the relationship between stress and emotional eating. For example, Gryzela and Ariana (2021) revealed a rather weak relationship between stress and emotional eating among university students working on their thesis, which occurred because of negative emotions such as anxiety and sadness that led to emotional eating responses. In addition, the results of Ling and Zahry (2021) also showed a relatively low relationship between emotional eating and stress among American students. in contrast to the two previous studies, research conducted by Savitri and Listiyandini (2017) found that there was a very strong relationship between stress and emotional eating, with a correlation value obtained of 0.747. The results of previous studies have many inconsistencies. Thus, researchers are encouraged to examine the interaction between stress and emotional eating in college students. Previous studies have been field studies in which researchers conducted research directly. Therefore, this study used meta-analysis to combine various study results to obtain a more comprehensive picture of the relationship between emotional eating and stress. Another reason for using meta-analysis is to combine data from many studies that have been conducted by increasing the overall sample size so that it can provide more stable results and has higher statistical power than individual studies. Another reason is to evaluate the extent to which the results of these previous studies are consistent by providing more reliable conclusions. The last reason this research will be conducted using meta-analysis is because no previous research has used this method to measure stress and emotional eating systematically.

LITERATURE REVIEW

Previous studies have highlighted research methods using quantitative methods that use psychological measuring instruments such as DEBQ and EES to measure emotional eating and PSS to measure stress (Wang & Li, 2017; He et al., 2021). However, there are many differences in the results obtained due to differences in subjects both in number and different subject criteria, so the results obtained are not consistent between one study and another, which is also influenced by external factors. This study was conducted to fill the gap in previous studies that did not use meta-

analysis as a research method. It is expected that using this method can provide stronger conclusions and broader generalization than individual studies, thereby resulting in more perfect and systematic output.

Stress is the physiological response of the human body to external pressure. These demands can be genuine and encompass current and future circumstances (Barseli et al., 2020). Meanwhile, Sarafino (1994) defined stress as the result of a person's interaction with their environment, which causes a mismatch between demands that come from a person's biological, psychological, and social systems. Researchers categorize harmful or destructive stress as distress and beneficial or constructive stress as eustress (Safaria & Saputra, 2009). Distress or negative stress has various negative effects, such as nervousness, high blood pressure, irritability, and difficulty in concentrating. Distress can be divided into two types. First, acute stress, which appears to be quite strong but disappears quickly. The second condition is chronic stress, which is less intense but can last for days, weeks, or even months (Gamayanti et al., 2018). Repeated stress can interfere with productivity and health in the body.

When facing stress, a person becomes more sensitive, has difficulty remaining relaxed, and lacks patience. It also impacts eating patterns, where a person may overeat without paying attention to hunger needs, prioritizing emotional comfort when enjoying "comfort food." It reflects changes in eating patterns associated with a coping stress mechanism called emotional eating (Pertiwi & Ulandari, 2023). Individuals tend to use emotion-focused coping strategies when facing stress, which is emotion-oriented when they interpret problems as circumstances or situations that cannot be changed (Sudarji et al., 2022). This makes emotional eating a strategy to deal with stress. In line with the findings of Fayasari and Lestari (2022), changes in eating habits were observed in student subjects during the COVID-19 pandemic. Most respondents stated that there were changes in eating habits as high as 66.3%. The forms of changes in eating habits experienced include increased appetite, increased frequency of eating, and increased consumption of food or sweet drinks.

How individuals deal with stress is closely related to their physical and mental health. For example, Kurniawan and Wardani (2023) suggested that academic stress may hurt sleep quality and worsen daily functioning. In addition to disrupting sleep quality, stress can disrupt eating quality, leading to emotional eating behavior. When individuals are faced with stressors that cannot be controlled by their coping mechanisms, their coping mechanisms stimulate the brain to release the hormone cortisol produced by the adrenal glands. The cortisol hormone is responsible for increasing an individual's desire to eat. Thus, stress indirectly affects biological pathways and is a major factor in changes in eating behavior (Gusni et al., 2022). Individuals often use food to cope with stress as a means of coping against emotions such as boredom, anxiety, sadness, and trauma. This behavior is known as stress-eating, which leads to overeating and can lead to various health problems, including obesity and heart disease (Rajkumar et al., 2023). The more severe the stress is, the higher is the consumption of high-energy and fatty foods. It can also occur because of the tendency to cope, which leads to consuming more food than usual, and the food consumed is fatty (Syarofi & Muniroh, 2020).

Emotional eating refers to the tendency to consume excessive amounts of food to manage and alleviate negative emotions, such as despair, worry, and stress (Shehata & Abdeldaim, 2023). According to the results of research by the Ministry of Health of the Republic of Indonesia (2018), emotional eating is a habit of excessive amounts of food that tends to be consumed in a variety of unhealthy foods and high in sugar, salt, and fat caused by emotions and not because of hunger. There are four types of emotional eating: trigger, cover up, false bliss, and hangover. A person who feels comfortable after consuming a lot of food under stress is classified as the false bliss type (Rahim & Prasetya, 2022).

Emotional eating is distinguished by the inability to differentiate between hunger signals caused by physiological processes and the compulsion to use food as a coping mechanism for negative emotions, including stress. Manister and Gigliotti (2016) demonstrated through their research that stress has a statistically significant and direct impact on emotional eating. Emotional eating can increase energy balance and fat storage, directly connecting acute stress reactivity with weight gain (Dallman, 2010). Cortisol is critical to emotional eating through its interaction with the hypothalamic-pituitary-adrenal (HPA) axis. Chronic stress increases cortisol levels, which can trigger increased appetite and the desire to consume high-calorie foods in response to psychological distress. As a glucocorticoid hormone, cortisol modulates the HPA axis, which regulates the body's response to stress. Prolonged cortisol exposure can alter the rhythm and sensitivity of the HPA axis, contributing to changes in adipose tissue metabolism and increasing the risk of obesity through physiological and behavioral stress responses (Lengton et al., 2024). In addition, cortisol release during stress plays a role in the regulation of emotional eating. In individuals with binge eating disorder, a blunted cortisol response correlates with increased urges to binge eat, suggesting chronic dysregulation of the HPA axis that affects food cravings (Rosenberg et al., 2013). Emotional eating is an emotionally volatile condition that does not rule out the possibility of individuals using eating behavior as a strategy to overcome negative emotions. When this happens, individuals will eat beyond the need for physical hunger, where not their body needs food but the emotional condition that must be satisfied with food (Rizkiana & Sumiati, 2019).

RESEARCH METHOD

This study used a meta-analysis to review various scientific articles discussing stress and emotional eating published in national and international journals. A meta-analysis is a synthesis of several studies that focus on the results found in these studies (Card, 2012). Meta-analysis was chosen as the method for this study because research related to emotional eating and stress has been conducted in various contexts and different sample methods. Therefore, meta-analysis is used to integrate the results of various studies to obtain a more comprehensive conclusion, and combining data from various studies can strengthen the accuracy of the results and also make it possible to explore other factors that affect the relationship between the two variables. In addition, Meta-analysis is used to assess the precision of measuring and analyzing the impacts of the research (Muhtadi et al., 2022). In addition to the above reasons, meta-analyses have an advantage over traditional systematic reviews in that the results of this study have a more in-depth analysis of the relationship between emotional eating and stress. This is because systematic reviews are more narrative in nature by presenting a summary of findings without conducting further analysis, whereas meta-analysis is more objective because it uses statistical analysis to test the relationship between emotional eating and stress so that it can provide stronger estimates and more accurate results.

In general, there are several steps in conducting meta-analysis according to Card (2012). First, formulating research problems; second, collecting literature materials through selection of articles and research results that are in accordance with the objectives to be achieved; third, evaluating research to find the information needed, fourth, analyzing and interpreting the results of literature collection; and fifth, presenting the results of meta-analysis in written form. This study built upon and enhanced previous research conducted between 2014 and 2024 that investigated the impact of stress on emotional eating. This study specifically focused on analyzing the relationship between variables by addressing the following questions: (1) how themes in emotional eating studies are related and grouped; (2) the results of the heterogeneity test; (3) the summary effect of the two variables; and (4) the presence of publication bias. The data sources in this study use indirect data or secondary data derived from research journals that have been conducted by

previous researchers and are relevant to the theme.

The first stage of the systematic review is an article search, which involves several stages. First, articles should be identified using Google Scholar, Scopus, PubMed, and the Web of Science databases publish or perish application. At this stage, the researcher entered the keyword "emotional eating" the article search field and was limited approximately 2014-2024. This search yielded 992 articles. Data from all articles were input into Excel and then analyzed using a software called VOSviewer, which was used to build and display bibliometric networks. The VOS viewer is the first step after discovering the main variables to find other connected variables; thus, this process is considered important in the meta-analysis stage. These networks can be built using citations, bibliographic coupling, co-citations, or co-authorship relations, and they can comprise articles from individual authors, journals, or researchers. VOSviewer used to see the network and variables often associated with emotional eating in the article. After learning the results of VOSviewer, there are several results, one of which is used as a variable to analyze emotional eating. Stress and emotional eating were selected as the variables to be analyzed. The researcher then conducted a second search using the publish or perish application with the keywords "emotional eating and stress" with the Google Scholar database in the article search column and limited between 2014-2024. From the search results, we found 992 articles. Of the total articles, only 162 discussed emotional eating and stress with the students. The researcher grouped the data using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) flow diagram to identify and eliminate articles that would be selected for meta-analysis. The PRISMA flow table is shown in Figure 1.

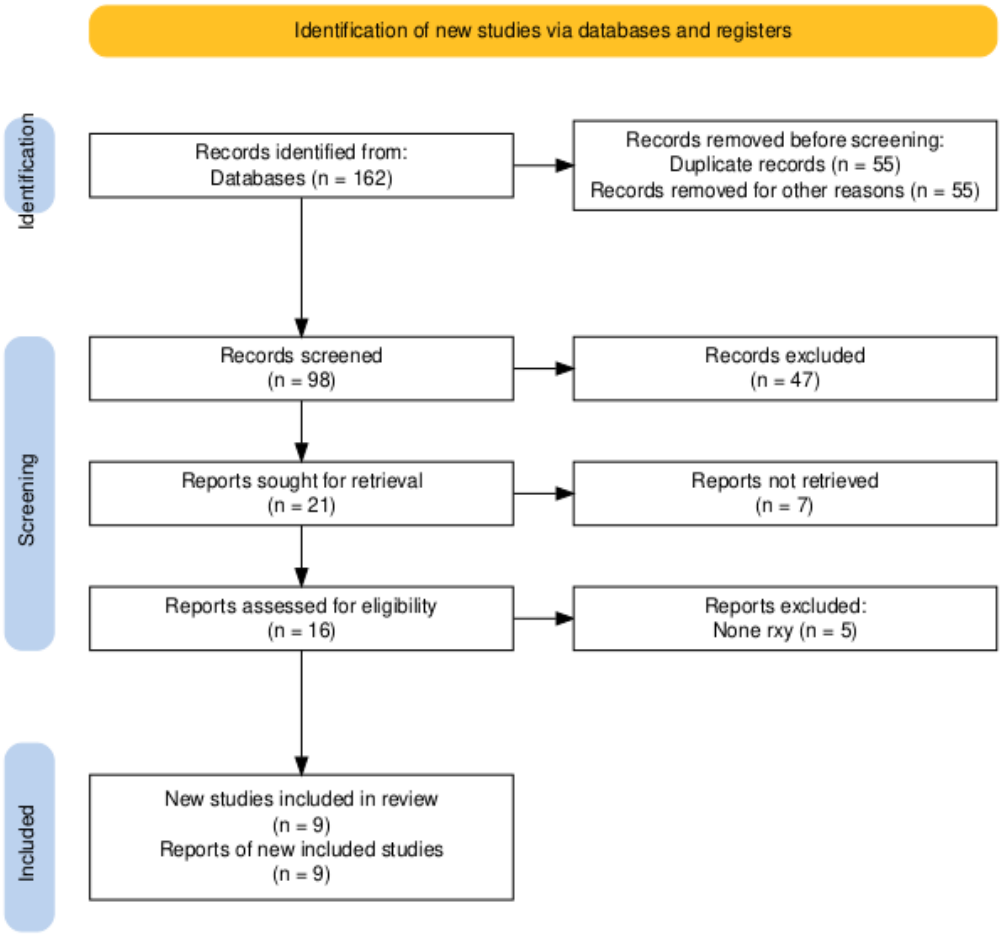

Figure 1. PRISMA flow

There were 162 articles found that were found in the emotional eating and stress search engine, consisting of Elsevier journals: 49, Springer: 38, Wiley Online: 26, MDPI: 21, Frontiersin: 10, Cambridge: 10, Taylor & Francis: 8. Of the 162 articles, 55 articles were discarded before screening for two reasons:, namely 28 were chapters from books, and 36 were results from proceedings. Furthermore, there were 98 articles that continued to be screened, and 47 had to be discarded for several reasons, such as 12 articles had differences in analysis, 23 articles had inappropriate methods, and 12 articles had different data. Furthermore, there were 16 articles that continued to be screened, and at this stage, as many as 5 articles had to be discarded because they did not have rxy, so that the remaining 9 articles passed the meta-analysis. The phase of reviewing articles produced data that could answer the research questions. Of the 162 articles obtained, many were eventually excluded from Prism for several reasons, such as differences in data analysis, different methods, incomplete data, and articles that could not be opened. Only 9 articles were selected for meta-analysis using the keywords "emotional eating, stress, college" and "emotional eating, stress, adolescent". The search results were obtained following the eligibility criteria, and 9 studies were identified that were eligible for further meta-analysis using meta-analysis. Meta-analysis is a statistical method that merges two or more comparable studies to derive a consolidated set of quantitative data (Yusuf, 2023). Prior to the meta-analysis, researchers also used VOSviewer to determine the results of publication distribution and variable collaboration networks and determine variables that appeared in the research theme.

The Meta-analysis examines the findings based on prior research and other data features, including the manipulation of variables, effect sizes, and sample sizes (Sugano & Nabua, 2020). The meta-analysis technique in this investigation, as described by Borenstein et al. (2009), involves the following steps: 1) Establishing inclusion criteria; 2) Gathering data and assigning codes to variables; 3) meta-analysis aims to enhance the sample size, improve the statistical power, enhance the precision and accuracy of effect estimations, produce estimates of effect size, and generate new hypotheses. The general principle in conducting a meta-analysis is that it is carried out systematically, follows a criterion, contains a collection of research results and, and is based on quantitative analysis.

The eligibility criteria of all research articles in the initial search were carefully reviewed and evaluated for subsequent analysis. The research papers were screened based on the following criteria: 1) The publication year dropped between the range of 2014 and 2024; 2) the research focused on the relationship between emotional eating and stress; 3) each article included data on the correlation coefficient (r) value; 4) each article had a minimum sample size of 20 individuals.

A correlation meta-analysis of the data was performed using JASP (Jefferey's Amazing Statistical Program) software, which is a free statistical analysis software made by the department of psychological methods, at the university of Amsterdam, the Netherlands. Analysis using the JASP application was chosen because in addition to being free and easy to use, JASP has complete meta-analysis features. Thus, its use so that the use of the application supports the analysis required in the meta-analysis. Before the meta-analysis, the researcher utilized VOSviewer to examine the study and identify gaps in the research and any newly discovered findings. Subsequently, the analysis was conducted using JASP. The meta-analysis process involves process of conducting a meta-analysis involves multiple distinct processes. These include: 1) converting each r value into the effect size for each research study; 2) conducting a test to assess heterogeneity; 3) calculating the summary effect; 4) creating a forest plot; 5) performing hypothesis testing; and 6) examining for publication bias.

FINDINGS AND DISCUSSION

After searching in the publish or perish application, the analysis was continued using VOSviewer to identify the network of several variables related to emotional eating. Data in the form of Excel files in RIS are obtained from the search results on publish or perish with the keyword "emotional eating," which is then input into the VOSviewer application. In the verified selected terms process, terms or words that match the topic of emotional eating are selected. The results obtained using VOSviewer are shown in Figure 2.

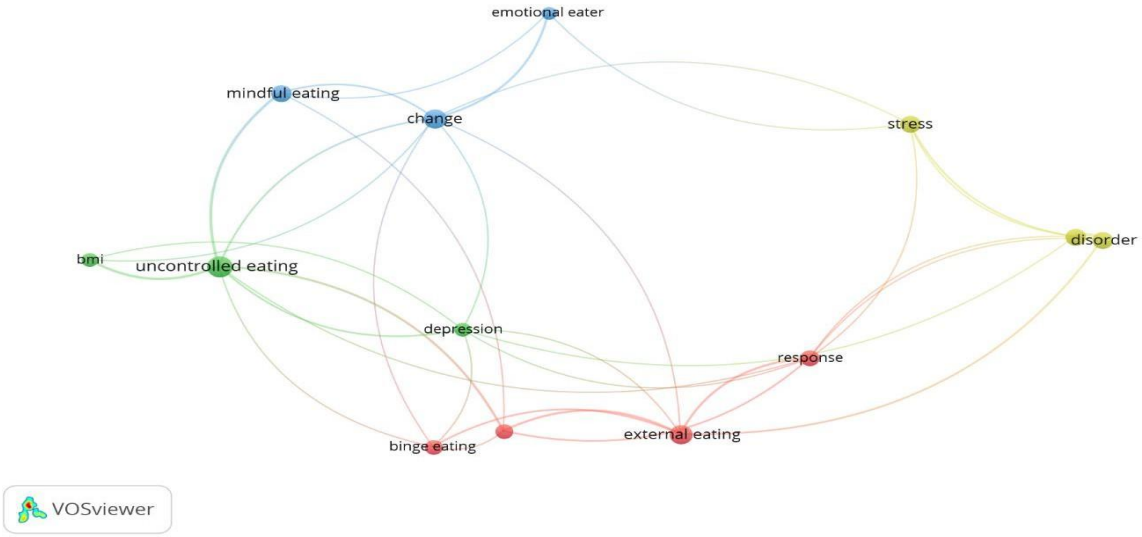

Figure 2. VOSviewer results

Based on the VOSviewer results, 11 networks were most frequently used to search for “emotional eating” from 2014 to 2024. Several variables appear in the search for emotional eating networks, such as binge eating, external eating, uncontrolled eating, mindful eating, emotional eating, depression, response, disorder, stress, and change. From these variables, the researcher chose stress as one of the variables to be tested with emotional eating from various networks because most articles discuss the relationship between emotional eating and stress.

After analysis using VOSviewer and review using the PRISMA flow, 9 selected articles were included in the meta-analysis. Prior to this, coding was carried out to clearly describe the characteristics of the publications used, such as the publication year, publication sample (n), research subject, correlation value (rxy), effect size (Z), variance z (Vz), and standard error z (Sez). The results are shown in Table 1.

Table 1. Data from 9 study articles

No.	Author and year	n	subject	rxy	Z	Vz	SEz
1.	Tan & Chow, 2014	345	Young adults	0,31	0,321	0,003	0,054
2.		45	Teenagers 12-17 years old	0,09	0,09	0,024	0,154
3.	Ling & Zahry, 2021	523	18-25 years old	0,24	0,245	0,002	0,044
4.	Yilmazturk et al., 2022	742	18-31 years old	0,31	0,321	0,001	0,037

No.	Author and year	n	subject	rxy	Z	Vz	SEz
5.	Shehata & Abdeldaim, 2023	580	Students and employees	0,13	0,131	0,002	0,042
6.	Fayasari & Lestari, 2022	303	College students	0,38	0,4	0,003	0,058
7.	Rahim & Prasetya, 2022	100	College students	0,32	0,332	0,01	0,102
8.	Pertiwi & Ulandari, 2023	169	College students	0,39	0,412	0,006	0,078
9.	Gryzela & Ariana, 2021	198	21-22 years old college students	0,14	0,141	0,005	0,072
Total		3005					

There were 9 studies consisting of 5 international journals and 4 national journals published from 2014 to 2023 with 3005 subjects. In the table of the subject section, it can be seen that some articles wrote students as their research subjects, but others only wrote about the age range of the subjects who were also still in the student category, and one article that wrote about the subject was in the young adult group. The next step was to conduct a statistical analysis of the 9 studies by collecting data on rxy from each study. Rxy is the correlation coefficient between variables X and Y is Rxy. In addition, Z (effect size) is collected to determine the magnitude of the effect between variables. Then, the calculation was performed using the following formula to determine the variance of Z (Vz) in each study. Finally, we calculated Sez (standard error effect size), which reflects the accuracy of the selected sample to the population. Sez is influenced by the number of samples and magnitude of the standard deviation of the effect size. The heterogeneity test was carried out on the data using JASP. The heterogeneity test results are shown in Table 2.

Table 2: Heterogeneity test results

Fixed and Random Effects			
	Q	**df**	**p**
Omnibus test of Model Coefficients	54.513	1	< .001
Test of Residual Heterogeneity	27.351	8	< .001

Note. P-values are approximate.

Notes. The model was estimated using the Restricted ML method.

The degree of freedom (df) value represents the total number of studies analyzed (N-1). The results revealed that the papers analyzed had heterogeneity across nine effect sizes. The presence of diverse data was deduced from the p-value <0.001; Q = 27.351. Hence, the random-effects model is better suited for calculating the average impact size of the nine studies examined. The results also suggest exploring moderator variables that impact the correlation between emotional eating and stress. According to Mueller et al. (2018), it is crucial for meta-analysis research to determine the extent of heterogeneity before concluding using a fixed-effects model. Table 3 displays the outcomes of the effect summary analysis, namely summary effect size.

The results of the analysis with the random effect model show that the p-value is <0.01, which means that there is a significant positive correlation between emotional eating and stress (z=

7.383; p <0.001; 95%CI [0.201; 0.347]). Meanwhile, the standard error estimate value indicates that the magnitude of the effect of emotional eating on stress is 0.274 and is included in the low category.

Table 3. Summary effect/Mean *effect size*

Coefficients						
					95% Confidence Interval	
	Estimate	**Standard Error**	**z**	**p**	**Lower**	**Upper**
intercept	0.274	0.037	7.383	< .001	0.201	0.347

Note. Wald test.
r = 0.1 (low); r = 0.3 (medium); r = 0.5 (high) (Cohen. 1988).

Furthermore, the results of the meta-analysis study can be summarized in the form of a forest plot chart. Figure 3 shows the forest plot results from the 9 studies analyzed follows.

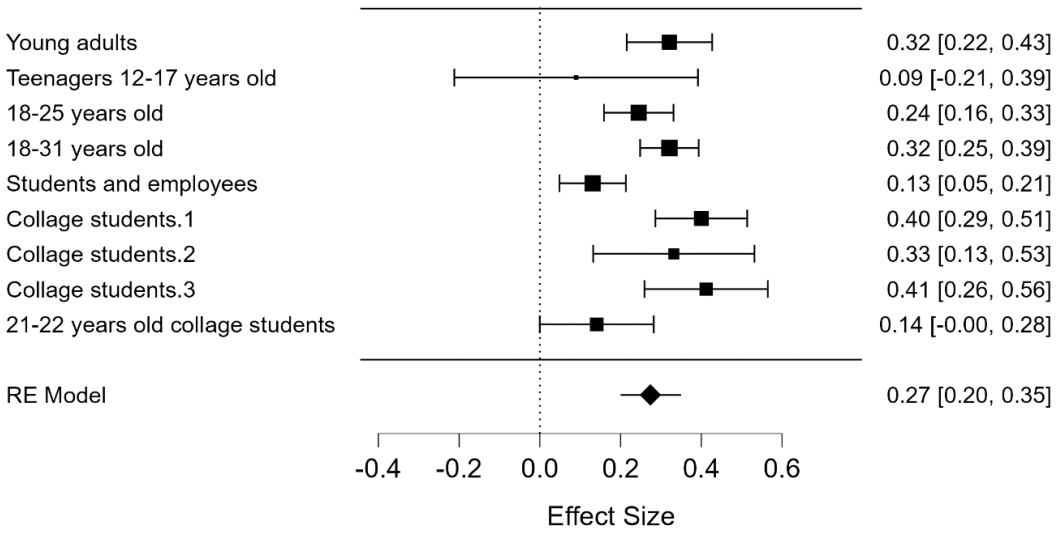

Figure 3. Forest plot

Forest plots typically display the names of the analyzed studies, the effect size value for each study, and the confidence interval's lower and upper limits. The black plot represents the magnitude of the effect. The effect size value increased as the position moved to the right. The size of a plot is directly correlated with its significance level, with larger plots being more significant or highly significant. Furthermore, the random effects (RE) model, represented by black plots in the shape of diamonds, displays the summarized effect size values of the 9 studies that were examined. The RE model value is equivalent to the estimated standard error of 0.27. Furthermore, the forest plot reveals that the effect size of the examined research ranges from 0.09 to 0.41. The forest plot provides a concise overview of the analysis performed.

A meta-analysis study is considered reliable if it does not exhibit publication bias. Publication bias is a form of bias that arises in academic research that has been published (Candra & Retnawati, 2020). Bias often arises when the outcomes of a study impact the determination of whether to publish or withhold the study. The data were analyzed using the Funnel Plot, Egger's Test, and Fail-Safe N techniques to examine this. The plotted line in the figure below reflects the aggregate effect size. The center line, which serves as a dividing point, separates the plot line and

determines the value that divides the derived summary effect size. A plot can be considered symmetrical if the distribution of the effect size values on the right and left sides is equal in both hemispheres. Figure 4 displays the findings of the Funnel Plot graph.

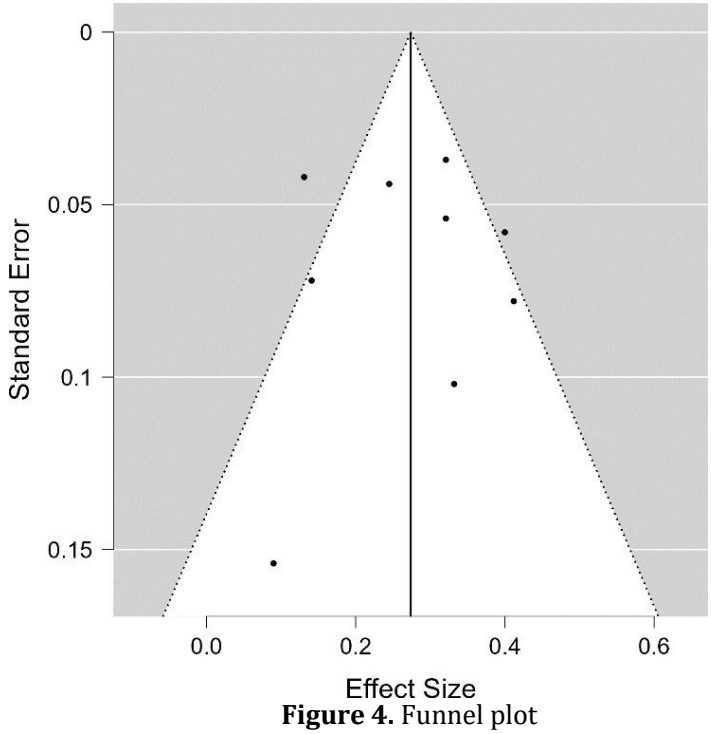

Figure 4. Funnel plot

Based on these findings, it is challenging to determine whether the Funnel Plot is symmetrical or irregular. Egger's Test and Fail-Safe N are necessary to assess the symmetry of the Funnel Plot. The outcome of Egger's test is a P-value of 0.754, indicating that the P value is more significant than 0.05. This confirms that the Funnel Plot is symmetrical even though the plot's distribution must be more regular. Therefore, this meta-analysis did not suffer any publication bias.

Table 4. Fail-safe N

	File Drawer Analysis		
	Fail-safe N	**Target Significance**	**Observed Significance**
Rosenthal	621.000	0.050	< .001

Furthermore, publication bias can be assessed by examining the Fail-Safe N value. In the Fail-Safe N value study, the Safe N value was determined to be greater than the value of 5K + 10, which was simplified to 5[9] + 10, resulting in a value of 55. From the table above, it can be seen that the fail-safe N value in the Rosenthal section is 621; thus, it can be concluded that this meta-analysis study does not have publication bias, which is indicated by the publication bias test conducted. In addition, it can be concluded that the results of the meta-analysis are robust and stable. In addition, the funnel plot and complementary heterogeneity test results reinforce the findings. Therefore, the findings of this meta-analysis are scientifically valid.

Stress is a natural part of every individual's experience, but it can become a pathological condition if a person cannot adjust correctly. The findings of this study indicate that the higher the level of emotional eating, the higher the perceived stress. Based on the results of the meta-analysis, emotional eating and stress were significantly positively correlated even though the effect was

relatively low (0.274). This indicates that other variables play a role in the relationship between the two. Of the 9 articles analyzed, emotional eating was the dependent variable, and stress was the independent variable. In addition, there were several variables that appeared in the study, such as emotional focus coping, emotion regulation, dietary restraint, intuitive eating, negative emotional reactivity, and gender. These variables may be one of the reasons why the relationship between emotional eating and stress has a low direct effect.

The subjects in this study are individuals who experience many transitions and changes; thus, they are vulnerable to stress. Students often experience two stressors. The first trigger is academic stressors, which include pressure to achieve academic standards, large course load, and time planning. Meanwhile, the second trigger was nonacademic stressors, such as dissatisfaction with personal appearance, life, and low self-esteem toward others (Beiter et al., 2015). Meanwhile, Chamberlin et al. (2018) stated that emotional eating behavior can be possible in people of all ages, genders, and ethnicities. This is in line with the results of the study, which have different variations in research subjects because the articles analyzed come from different countries, so they have ethnic differences, and also differences in the gender of women and men are also one of the factors that influence the results of each article.

Other research findings from studies on emotional eating and stress show that gender differences affect the level of emotional eating. Some studies have explained that women experience more emotional eating than men because women tend to eat more than men in response to negative emotions due to depression and anxiety and respond to stressors in life by consuming food . Other studies have also shown that emotional eating is more common in female students than in male students. During the COVID-19 pandemic, the group most vulnerable to emotional eating is adolescent girls with excessive body mass. They are prone to weight gain during COVID-19 and generally experience high levels of stress when facing negative emotions (Skolmowska et al., 2023; Yilmazturk et al., 2022). Although the results revealed a low association between emotional eating and stress, individuals who are prone to emotion-based eating when facing academic and social pressures may still exist. Therefore, we should not only focus on stress-based interventions, but also consider other factors that can influence eating habits, such as sleep patterns, social environment, and emotion regulation. One way to prevent emotional eating is to practice mindful eating. The results of previous research indicate that mindful eating is more effective in overcoming emotional eating by practicing mindfulness, which helps students manage eating behavior and reduce emotional triggers related to food consumption (İNözü & Köse, 2023). In addition, campus mental health programs can integrate education about self-awareness in eating patterns, healthy coping strategies, and social support to help students manage stress without relying on food. In addition to education, campuses can also create counseling service programs for students who find it difficult to manage academic stress (Prasetya & Hidayati, 2024).

In addition, the measurement tools used in this meta-analysis have various variations. In the measurement of stress, six of the nine studies used the PSS (Perceived Stress Scale) as the measurement tool used in data collection. Two studies used the DASS (Depression, Anxiety and Stress Scales) and one study used the ASQ (Attributional Style Questionnaire). In the emotional eating variable, three measuring instruments were used in the research: one study using TFEQ (three-factor eating questionnaire), three studies using EES (Emotional Eating Scale), and five other studies used the DEBQ (The Dutch Eating Behavior Questionnaire). The various differences in the use of measuring instruments in data collection affect the results of each study; thus, further studies are needed regarding the results of each diverse study.

CONCLUSIONS

The results of the meta-analysis test show that emotional eating and stress have a weak but

not strong effect. According to the mean effect size study, emotional eating substantially impacts stress. This result is supported by a p-value of less than 0.001 and an estimated standard error of 0.274, indicating that the influence is low. Nonetheless, this is important because it provides insight into the extent to which emotional eating has an influence on coping with stress and what other factors or variables may play a role in the relationship. There are two possible reasons for the weak relationship between the two variables. First, emotional eating is not an effective coping mechanism for stress. Although eating helps to deal with negative emotions, it is only temporary, and the effect is not very long-lasting. The second factor is that individual differences in emotional eating differ. For example, differences in personality, emotional regulation, past experiences, and social environment can affect the extent to which emotional eating is used as a coping strategy.

The results of this heterogeneity test suggest exploring additional moderator variables that influence the connection between emotional eating and stress. Furthermore, the absence of publication bias ensures that the study findings can be scientifically validated. Further research on the causes and effects of stress on emotional eating or its influence on other variables is required.

LIMITATION & FURTHER RESEARCH

This study has several limitations. First, there are only 9 studies analyzed due to the limited number of studies on emotional eating and stress that met the eligibility criteria, so the data obtained should be more extensive. Second, changes in emotional eating and stress responses may vary with time and geographical location because the research articles have different durations and geographical locations, which then affect the social and cultural differences of the subjects studied. This study only used a sample of university students as research subjects, so it is hoped that future researchers can expand the sample.

This study successfully examined the relationship between emotional eating and stress in college students even though the correlation results were in the low category, but this is a new finding that there are several factors that cause the correlation results to be in the low category, such as differences in the measuring instruments used, the influence of other variables such as emotional regulation, BMI, anxiety, or individual coping strategies, and individual differences in responding to stress can also be a factor.

In the future, it is hoped that future researchers can examine why the relationship between these two variables is relatively low by testing and adding other variables such as BMI, anxiety, emotion regulation, and even family and social factors that may also have an effect on emotional eating and stress. In addition, future researchers are also expected to add new articles to the meta-analysis to ensure that the results obtained are more accurate and representative. In addition, when including articles in the meta-analysis, ensure that the measurement tools used are consistent and, if possible, use the same measurement tools. Finally, in the future, research can be conducted on how culture and social norms can affect the relationship between emotional eating and stress by involving diverse populations and backgrounds.

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