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RESEARCH ARTICLE

Differences in the Model of Eating in the Absence of Hunger Before and During the COVID-19 Pandemic

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Abstract:

Introduction:

The obesity rate among adults in Indonesia continues to increase, and even almost doubles in a decade. In the study of eating behavior, one of the causes of obesity is due to eating out of hunger. The study has proposed a conceptual model of eating in the absence of hunger [EAH]. EAH was examined through the influence of eating styles and hedonic hunger. In addition, the mediating role of palatable eating motives and loss of control over eating were also included in the model. In this paper, we mainly focused on the influence of environmental situation namely the occurrence of the COVID-19 pandemic. It was necessary to see whether the COVID-19 pandemic situation would make a difference to the proposed model. The study aimed to compare data taken before COVID-19 with data taken during the COVID-19 pandemic.

Methods:

This study involved 753 respondents who were dominated by female and university students aged 18-25 years who were studying in Jakarta using convenience sampling. Data were collected using a self-report questionnaire. The data before the COVID-19 pandemic was collected in February - March 2020 by paper and pencil. The data during COVID-19 was collected using the online form in June-July 2020. Data were analyzed using multigroup analysis.

Results:

The analysis results denoted that the model proposed was fit with the data even though the two data groups were not invariant.

Conclusion:

This means that special situations, such as the COVID-19 pandemic have an impact on EAH.

Keywords: COVID-19, EAH, Eating in the absence of hunger, Eating styles, Hedonic hunger, BMI.

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1. INTRODUCTION

Based on data from the 2018 Basic Health Research [1] [1], the obesity rate in Indonesia continues to rise. In addition, the diet pattern in Indonesia is quite alarming because Indonesia is experiencing a double burden in terms of stunting cases and the category of abnormal Body Mass Index (BMI). Obesity itself is defined as excessive fat accumulation or an abnormal condition that can interfere with health [1, 2]. Cases of death due to obesity are more common than cases of death caused by underweight. This is because obesity triggers various non-communicable diseases such as sleep disorders, type II diabetes mellitus, and coronary heart disease [1]. According to the Ministry of Health, there are at least two impacts caused by obesity [1]. First, the impact of metabolic or metabolic syndrome, namely increased triglycerides, decreased HDL cholesterol, and increased blood pressure. Second, other effects of obesity include knee and hip osteoarthritis, gallstone formation, sleep apnea or sleep disturbances, to low back pain. In the future, health problems arising from obesity will certainly increase healthcare funds. In addition to health problems, obesity also causes social problems. In short, if not addressed, obesity will not only have an impact on health and

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physical appearance but also on social and economic problems.

Obesity according to the Ministry of Health [1] is caused by several factors. The first factor is genetic factors which contribute about a 40-50% chance of obesity in children if one parent is obese. The chance increases to 70-80% when both parents are obese. The second factor is environmental factors, such as diet and physical activity. The next factors are drugs and hormones which play a role in the occurrence of obesity. The Indonesian government has established an intervention program, namely the Nusantara Movement to Reduce Obesity Rates which regulates diet and encourages obese people to be active. However, data shows that from year to year, the number of obesity cases in Indonesia and the world is getting higher [1]. This confirms that nutritional and medical approaches are not sufficient to explain this. Behavioral aspects, in this case, individual psychological dynamics, also need to be understood.

In this study, the model proposed to explain the variable Eating in the Absence of Hunger (EAH). The EAH studied is beginning EAH (BEAH) or eating when someone is not yet hungry and continuing EAH (CEAH) or continuing eating when someone has just finished eating or is already full. EAH was examined retrospectively so that the relationships with variables suspected to be the predictors, or which will be used as independent variables [IV] can be seen. In the model, we propose IVs, namely: eating styles and hedonic hunger. Eating styles are included as predictors because they can describe the unique structure of an individual's eating behavior. Three eating styles become predictors, namely uncontrolled eating, emotional eating, and cognitive restraint. This is in line with research from Lansigan, Emond, & Gillbert-Diamond [3] which states that there is a relationship between EAH and eating styles, but how environmental influences EAH needs to be investigated further. Therefore, in addition to eating styles, hedonic hunger is also an IV because it describes how the food environment affects thoughts, and feelings, and encourages an individual to eat. Research from Feig, Piers, Kral, & Lowe [4] found that hedonic hunger is associated with EAH. We also proposed palatable eating motives (PEM) and loss of control over eating (LOCE) as mediators in this study. Palatable eating motives (PEM) serve as a mediator because in social psychology, motives are an integral part of behavior [5], so to understand EAH behavior, it is also necessary to see how much influence the motives have. Loss of control over-eating (LOCE) as a mediator is used to see whether it mediates the occurrence of EAH or whether EAH and LOCE are related but separately independent [6]. The proposed model can be seen in Fig. (**1**).

Our proposed model has already been tested, in a concise form, we summarize the hypothesis and the results as seen in the Table **1**.

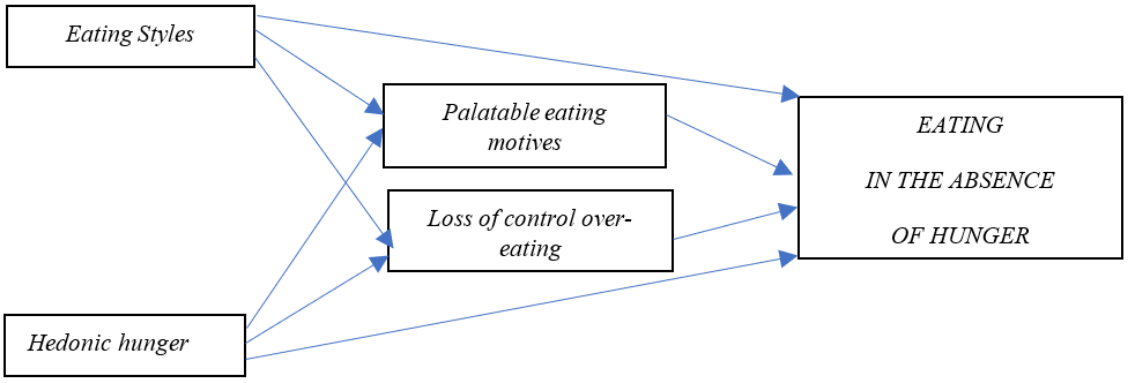

Fig. (1). Model proposed of eating in the absence of hunger.

Table 1. Hypothesis and results of the proposed model.

Hypotheses	EAHB	CEAH
H1: There is an effect of uncontrolled eating on EAH.	rejected	rejected
H2: There is an influence of emotional eating on EAH.	Accepted	Accepted
H3: There is a cognitive restraint effect on EAH.	rejected	Accepted
H4: There is an effect of hedonic hunger on EAH.	Accepted	Accepted
H5: There is an effect of uncontrolled eating mediated palatable eating motives on EAH.	rejected	rejected
H6: There is an effect of emotional eating mediated by palatable eating motives on EAH.	Accepted	Accepted
H7: There is an effect of cognitive restraint mediated palatable eating motives on EAH.	rejected	rejected
H8: There is an effect of hedonic hunger mediated by palatable eating motives on EAH.	Accepted	Accepted
H9: There is an effect of uncontrolled eating with loss of control over eating mediated on EAH.	rejected	rejected

(Table 1) contd.....

Hypotheses	EAHB	CEAH
H10: There is an effect of emotional eating mediated loss of control over eating on EAH.	rejected	rejected
H11: There is a cognitive restraint effect mediated by loss of control over eating on EAH.	rejected	rejected
H12: There is a hedonic hunger effect mediated by loss of control over eating on EAH.	rejected	rejected

On March 20, 2020, through the governor's decree number 337 of 2020, Jakarta was declared in a state of emergency response to the COVID-19 outbreak. Large-scale Social Restrictions were imposed so that public activities, such as educational institutions, were temporarily suspended. All activities involving crowds were prohibited. On April 9, 2020, the virus was declared to have spread to 34 provinces in Indonesia. Not only in Jakarta, but almost all places in Indonesia carried out large-scale social restrictions, both officially and unofficially. The public was advised to stay and work from home to suppress the spread of the virus.

According to Haddad *et al*. [7], there were changes in eating behavior during the COVID-19 pandemic. During the pandemic and quarantine, humans who are social creatures became psychologically depressed and developed various coping mechanisms, one of which is eating. Individuals tended to eat more during the COVID-19 pandemic [8], and the types of food they are tended to be comfort food [Haddad *et al*., 2020] and unhealthy ones [9]. Some of these findings are very consistent with the activity of eating in the absence of hunger. Restrictions on social activities that occurred during the COVID-19 pandemic caused anxiety so eating became a form of coping mechanism. In addition, just staying at home means that environmental exposures, especially those related to food, would certainly be different from the period before the COVID-19 pandemic occurred. Therefore, in this paper, we wanted to highlight if the theoretical model we proposed was influenced by the COVID-19 pandemic. Specifically, this study aimed to see whether there were differences in the data groups before and during the COVID-19 pandemic. The purpose of this comparison was to see if there are differences in the mean eating styles, hedonic hunger, PEM, LOCE, and EAH in the two different situations.

2. METHOD

Participants in this study were students aged between 18-25 years with exclusion criterias: those who were not taking drugs that caused changes in body weight or appetite were pregnant and were also not under medical or psychiatric conditions that would interfere with data collection. The sampling technique was convenience sampling. Participants involved in this study were 766, but only 753 data that could be analyzed further. The data cannot be analyzed further due to several reasons. In the group data before the COVID-19 pandemic, five data were not used in the analysis because more than 80% of the answers were incomplete. For data during the pandemic, 8 data were not analyzed because they were included in the exclusion criteria previously mentioned. The data in the group before the COVID-19 pandemic (Group A) were 480 and the data for the comparison group taken during the COVID-19 pandemic situation (group B) were 273. Group A consist of 25.9% male and 74.1% female, and in group B consist of 21/6% male and 79.4% female. For the BMI, the description as in Table **2**.

Data for Group A was collected in February and March 2020 using the paper and pencil method, and data for Group B was collected in June-July 2020 using an online Google form. Even though the methods of gathering data were different, the data collection was ensured as equivalent. First, the questionnaire used contained the same question items in the same order. Second, after the data was obtained, the researcher also compared the psychometric components of the two groups by comparing the reliability achieved in both data, by comparing the Alpha values. Third, the respondent criteria set for the data group, both before and during the COVID-19 pandemic were the same.

Table 2. BMI cathegory.

BMI	Group A		Group B	
	Frequency	In Percent	Frequency	In Percent
Underweight	96	20%	54	19.77%
Normal	271	56.5%	171	62.63%
Overweight	83	17.3%	39	14.3%
Obese	30	6.3%	9	3.3%

The measuring instrument used was a measuring instrument for self-reporting the results of the adaptation carried out by the author. The measuring instrument used in this study can be seen in the Table **1**.

The study examined the theoretical model and the effect of exogenous variables on mediator variables and endogenous variables from the data taken before the COVID-19 pandemic occurred using multigroup analysis. Multigroup analysis is an analysis method that can be used to find answers to the question of whether latent means in the invariance model among groups [15].

Several questions can be asked to look for variations between groups: 1) Does the measurement model not vary between groups?; 2) Does the structural model not vary between groups?; 3) Do the particular paths specified in the structural model not vary between groups?; 4) Does the latent means of certain constructs in the model not vary between groups?; and 5) Do the factor loads of the measurement model not vary between groups? This study focuses on the fourth question, which is to see whether there are differences in latent means of eating styles, hedonic hunger, palatable eating motives, and loss of control over eating, and whether EAH is different in the two data groups? The data analysis is carried out using R software.

3. RESULTS

The researcher tested the hypothesis by comparing the data groups before (group A) and during the COVID-19 pandemic (group B). The result is presented for both types of EAH: Beginning EAH (BEAH) and Continuing EAH (CEAH).

3.1. Beginning EAH

The evaluation model for BEAH has shown that the model fits the data. Multigroup analysis was carried out by constructing baseline models for the two different samples, namely multigroup by equalizing (constraints) loading factors, covariance, variance, and the regression path coefficient. The model without constraints was then analysed. Chi-square and other fit index scores of baseline models and the real model were compared and differences in the values of chi-square and other fit indices were calculated; if they differ significantly, it can be concluded that the models of the two groups are different. In this study, the difference in the mean of the two groups were compared. In the table below, the comparison between no constraint and constraint models is presented. Based on the data from the following table (Table **2**), it is known that there are differences in the two data groups before and during the COVID-19 pandemic with a significance level of 5%.

The latent means test was carried out by setting the mean of group A = 0 and the mean of group B as an independent variable. If it is found that the mean of group B is not zero and the sign is positive and significant, then the mean of that variable in group B is significantly higher than the mean of the same variable in group A. If the sign is negative, it means that the mean of Group B is lower in group A.

In Table **3**, it can be seen that the mean in group B or data group during the COVID-19 pandemic is greater than group A or before the COVID-19 pandemic on variables HH, PEM, and LOCE. In the variables EAH, UE, EE, and CR, the mean of group B is lower than group A. However, in the multigroup test, it turns out that the difference in the mean of each variable for the two groups is only significant for UE, HH, PEM, and LOCE.

3.2. Continuing EAH (CEAH)

The evaluation model for BEAH has shown that the model fits the data for the results of hypothesis testing about the effect of exogenous variables on endogenous variables, either directly or indirectly (attached table). In Table **4**, the comparison between no constraint and constraint models is presented. Based on the data from the following table, it is known that there are differences in the two data groups before and during the COVID-19 pandemic with a significance level of 5%.

Table 3. Survey tools.

S. No.	Variable	Scale	Author/Refs.	Factor/Aspect
1	Eating in the absence of hunger	Adapted EAH-C	Arnold *et al*. [10],	1. Emotional 2. External 3. Physic
2	Eating styles	Three-factor eating questionnaire R-18	Cappelleri *et al.* [11],	1. Uncontrolled eating 2. Emotional eating 3. Cognitive restraint
3	Hedonic hunger	The power of foods scale	Lowe *et al*. [12],	1. Food availability 2. Food present 3. Food tested
4	Palatable eating motives	Indonesian version of palatable eating motives scale	Cahyani *et al*. [13],	1. Coping 2. Reward enhancement 3. Social 4. Conformity
5	Loss of control over eating	Loss of control over eating scale	Latner *et al*., [14	1. Behavior 2. Cognitive/ dissociative 3. Positive/ euphoric aspects

Table 4. Results of evaluation model of multigroup invariance test.

Model	df	$\Delta\chi^2$	Δdf	P-value
No constraint	714	129.85	73	0.000
Constraint	787			

Table 5. The results of the evaluation of the mean value comparison.

Latent Variable	Mean	Z-value	P-value	Sig
EAH	-0.16	-0.880	0.379	Insignificant
UE	-0.127	-3.42	0.001	Significant
EE	-0.016	-0.287	0.774	Insignificant
CR	-0.125	-1.764	0.078	Insignificant
HH	0.242	3.783	0.000	Significant
PEM	0.471	6.186	0.000	Significant
LOCE	0.239	3.771	0.000	Significant

Notes: EAH: Eating in the Absence of Hunger; UE: Uncontrolled Eating; EE: Emotional Eating; CR: Cognitive Restraint; HH: Hedonic Hunger; PEM: Palatable Eating Motive; LOCE: Loss of Control Over Eating.

Table 6. Results of evaluation model of multigroup invariance test.

Model	df	$\Delta\chi^2$	Δdf	P-value
No Constraint	714	130.57	73	0.000
Constraint	787			

Table 7. The results of the evaluation of the mean value comparison.

Latent Variable	Mean	Z-value	P.value	Sig
EAH	-0.08	-0.52	0.60	Insignificant
UE	-0.13	-3.42	0.00	Significant
CR	-0.13	-1.76	0.08	Insignificant
EE	-0.02	-0.28	0.78	Insignificant
HH	0.24	3.78	0.00	Significant
PEM	0.46	5.89	0.00	Significant
LOCE	0.22	3.43	0.00	Significant

Notes: EAH: Eating in the Absence of Hunger; UE: Uncontrolled Eating; EE: Emotional Eating; CR: Cognitive Restraint; HH: Hedonic Hunger; PEM: Palatable Eating Motive; LOCE: Loss of Control Over-Eating.

The latent means test was carried out by setting the mean of group A = 0 and the mean of group B as an independent variable. If it is found that the mean of group B is not zero and the sign is positive and significant, then the mean of that variable in group B is significantly higher than the mean of the same variable in group A. If the sign is negative, it means that the mean of Group B is lower in group A.

In Table **5**, the mean in group B or data group during the COVID-19 pandemic is greater than group A or before the COVID-19 pandemic on variables HH, PEM, and LOCE. In the variables EAH, UE, EE, and CR, the mean of group B is lower than group A. However, in the multigroup test, it turns out that the difference in the mean of each variable for the two groups is only significant for UE, HH, PEM, and LOCE (Tables **4** - **7**).

4. DISCUSSION

In this paper, we focused on the hypothesis that there are differences in the mean eating styles, hedonic hunger, PEM, LOCE, and EAH in the two different situations. Previously we already tested several hypotheses

Multigroup analysis showed the values of chi-square and other fit indices of baseline models and the real model were compared and the difference in the values of chi-square and other fit indices were calculated; the result was significantly different. In this study, differences between the two groups were seen from the latent means. Based on the results of the analysis obtained, it can be concluded that in this study, data group A taken before the COVID-19 pandemic and data group B during the COVID-19 pandemic were different or not invariant. Specifically, differences occurred between the latent means of uncontrolled eating, hedonic hunger, palatable eating motives, and loss of control over-eating. Similar results were found with beginning EAH (BEAH) and continuing EAH (CEAH). On the uncontrolled eating variable, the average during the COVID-19 pandemic was lower than before the COVID-19 pandemic. The average of hedonic hunger, palatable eating motives, and loss of control over eating variables during the COVID-19 pandemic was in fact higher than before the COVID-19 pandemic.

Uncontrolled eating is defined as a higher response to external signals from food such as food presentation, aroma, and taste [16]. On uncontrolled eaters, this sensitivity to external responses is not accompanied by good self-restraint [16]. Interestingly, based on these findings, uncontrolled eating was instead lower during the COVID-19 pandemic. This can be interpreted as a decreased sensitivity to external responses or the ability to hold on to good food. However, further research is needed. A possible explanation is that during this pandemic,

there was an appeal to stay at home and the PSBB occurred, which resulted in restrictive rules including for culinary businesses by prioritizing the delivery or take-away system. Direct exposure of food to individuals was limited so this may be what lowered the average of uncontrolled eating. It is different from hedonic hunger whose average was higher during the COVID-19 pandemic. Hedonic hunger is a subjective state within an individual that reflects the appetite [4] so that hedonic hunger causes frequent thoughts, feelings, and urges related to food even when someone is not physically hungry. These food-related thoughts, feelings, and impulses are not necessarily triggered by the direct presence of food as there are things that evoke the external response of uncontrolled eating, for example, smell, shape, and taste. On hedonic hunger, even the image of delicious food can encourage these thoughts. The COVID-19 pandemic situation limited social mobility so almost all activities were centered at home. However, connections with the outside world still occurred by using the internet, including connections with various types of delicious food, one of which was with social media where food was one of the most popular upload themes on social media. This seems to be one of the things that made hedonic hunger increase during the COVID-19 pandemic.

Palatable eating motives also had a higher average during the COVID-19 pandemic than before the COVID-19 pandemic. This means that the motive for eating delicious food was higher during the COVID-19 pandemic. The motives contained in PEM are 1) to cope, 2) because of the taste of food, 3) for social reasons or to brighten up the atmosphere, and 4) for reasons of conformity or to get social acceptance. These motives were very likely to increase in the conditions of the COVID-19 pandemic where the pandemic situation made everyone change and in an uncertain situation. Changes in habits occurred as there was a reduction and restriction of mobility and the habit of implementing health protocols. The uncertain situation due to the situation of the COVID-19 pandemic was very unpredictable, especially regarding when it would end. Facing this, of course, individuals needed to make coping strategies and one of which is by eating. In addition, the COVID-19 pandemic situation has made more people, especially students who became respondents, have to stay with their families at home. This would certainly trigger social and conformity motives in terms of palatable eating motives.

Loss of control over eating also had a higher average during the COVID-19 pandemic. In this study, in general, LOCE was found to have no significant effect on the occurrence of eating in the absence of hunger. However, as discussed earlier, loss of control over eating, although had no effect on EAH, is a marker and differentiator of overeating from binge eating as a form of eating disorder [6]. During the COVID-19 pandemic situation, the average was even higher so it could be the start of further investigations regarding the connection between the pandemic situation and eating disorders.

The results of the multigroup analysis which showed that there were differences in latent means before and after the COVID-19 pandemic showed that situational factors did cause changes in all segments of life, including eating behaviour. Therefore, the placement of contexts, such as situations, is something that must be done in research related to eating behaviour. In previous research, it was stated that indeed, the COVID-19 pandemic condition encouraged changes in eating behaviour both positively and negatively [7, 9, 17 - 19]. This study reaffirms that eating is not only determined by the homeostasis that occurs within the individual. This research proves that the psychological dynamics of the individual and the environment as well as the situation are very influential on the dynamics of eating behaviour. The models proposed under both conditions, both before and during the pandemic, are acceptable. However, the context at the time of data collection distinguished the dynamics of the two.

This research is certainly not free from various limitations. First, as explained earlier, the respondents in this study were not evenly distributed in terms of gender. This study was dominated by females, whereas gender is a fairly influential factor in eating behavior [19]. Second, this study did not consider cultures even though Indonesian cultures, especially those related to eating behaviour, are quite complex and vary from one region to another [20]. The discussion about food is not only about nutrition and hunger or homeostasis, but it is also associated with hedonistic reasons. There are many other functions of eating, including strengthening family ties, developing friendships, forms of hospitality, and so on, which are unique from one region to another. These characteristics will form a special pattern and cause differences in eating behaviour. Thus, considering culture will provide clearer and more specific insights, especially if it is aimed at interventions, either promotive, preventive, or curative.

CONCLUSION

The results of the multigroup analysis showed that the two groups were significantly different. There is a difference in latent means in the data groups before and during the COVID-19 pandemic. The latent mean of uncontrolled eating was significantly lower during the COVID-19 pandemic, whereas hedonic hunger, palatable eating motives, and loss of control over eating were significantly higher during the COVID-19 pandemic. In future research, it is possible to compare all measurement models in multigroup analysis so that a clearer picture can be obtained of how the COVID-19 pandemic situation brings differences, especially to EAH. In addition, the conditions of data collection must also be considered in conducting research related to EAH.

AUTHORS' CONTRIBUTION

Anggita Dian Cahyani conceptualized, designed, and prepared the initial draft and framework and interpreted the data. Aulia Iskandarsyah, Surya Cahyadi, and Wilis Srisayekti conceptualized the data.

LIST OF ABBREVIATIONS

BEAH	=	Beginning of Eating in the Absence of Hunger
CEAH	=	Continuing Eating in the Absence of Hunger
CR	=	Cognitive Restraint
COVID-19	=	Corona Virus Disease found in 2019

EAH	=	Eating in the Absence of Hunger
EE	=	Emotional Eating
HH	=	Hedonic Hunger
LOCE	=	Lose of control Over Eating
PEM	=	Palatable Eating Motive

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research is approved by the Research Ethics Committee Universitas Padjajaran Bandung, Indonesia. No. 1176/UN6.KEP/EC2019.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants of this study.

STANDARDS OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest financial or otherwise.

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Declared none.

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