Breaking the Stereotype: Is Women with Environmental Food Knowledge Eat more than Men?

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Abstract

Non-communicable diseases (NCDs) such as obesity have increased from 14.8% to 21.8% since 2018. One of the causes of this rise in obesity is individuals taking larger portions than their ideal size. It is suspected that knowledge of environmentally friendly foods influences portion size, thereby impacting the environment. Besides knowledge of environmentally friendly foods, hunger is also predicted to play a significant role in determining portion size. Therefore, research is needed on the influence of knowledge of environmentally friendly foods and hunger on portion size. The researchers aim to investigate further the influence of knowledge of environmentally friendly foods and hunger on portion size from a gender perspective. This study uses a quasi-experimental design method with 123 participants. Data analysis uses a generalized linear model. The results of this study indicate that the interaction between gender, knowledge of environmentally friendly foods, and hunger affects portion size (p= .008), the interaction between gender and knowledge of environmentally friendly foods affects portion size (p=.005), the interaction between gender and hunger affects portion size (p=.013), and gender has a positive and significant effect on portion size (p=.012). Future research can review personal factors such as behavioral intentions, values, and attitudes. In addition, considering that portion size is an external factor that can be modified, it is necessary to educate the public about appropriate and more environmentally friendly portion sizes.

Keywords: Environmental food knowledge, hunger, portion size, gender.

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Introduction

Non-communicable diseases (NCDs) kill 41 million people annually, equivalent to 74% of all global deaths (World Health Organization, 2022). Each year, 17 million people die from NCDs before the age of 70. Of all NCD deaths, 77% occur in low- and middle-income countries, such as Indonesia. In Indonesia, NCDs have seen a drastic increase since 2010, evidenced by the prevalence of obesity among adults aged 18 and above rising from 14.8% to 21.8% (Riskesdas, 2018). Obesity is influenced by various factors, including larger portion sizes (Rolls et al., 2007).

Portion size refers to the amount of food or dish consumed by an individual during a meal (Valdez, 2022). The appropriate portion size can be unique to each person and varies among individuals. Nevertheless, larger portions lead to increased food and calorie consumption, as the amount of energy consumed during meals is largely determined by the type and size of portions chosen (Yang et al., 2019).

When choosing portion sizes, the environmental friendliness of food needs to be considered. This is because larger portion sizes often require more energy and water for food production, with about 20-30% of it having adverse environmental impacts (Tukker & Bart Jansen, 2008; Ilhami et al., 2023). Knowledge of healthy foods, particularly regarding environmentally friendly foods, is thought to influence

an individual's food choices (Perignon et al., 2017). This suggests that merely following dietary recommendations does not automatically lead to more environmentally friendly eating behaviors (Perignon et al., 2017; van de Kamp et al., 2018). Therefore, relevant knowledge is a prerequisite here. Those with environmental knowledge should make environmentally friendly choices (Peschel et al., 2016). However, only a few laypeople have insights into the environmental friendliness of food (Hartmann et al., 2021). In addition to knowledge of environmentally friendly foods, hunger is believed to play a crucial role in individual portion sizes.

Hunger refers to the uncomfortable or painful physical sensation caused by inadequate energy intake from food (FAO, 2022). In response to this signal, individuals may choose portions that exceed their actual body needs. In hungry conditions, the portion size chosen reflects the expected feeling of fullness (Yang et al., 2019). Foods that are expected to not induce prolonged satiety are usually chosen in larger portions (Benton, 2015), potentially leading to obesity. Besides hunger, another predictor in portion size selection is gender.

Previous research indicates differences between men and women in food responses (Fraser et al., 2000; Gerhards & Rössel, 2003; Manippa et al., 2017). Men estimate their ideal portion sizes to be larger than women (Duszka et al., 2022). Differences in eating behaviors can be influenced by sociocultural and psychological factors. For example, societal perceptions regarding ideal body weight for women versus men. However, it is important to emphasize that food preferences, including portion sizes, are often culturally based. Gender differences found in one culture may not occur in another (Rozin, 2009). Moreover, some previous studies also suggest further testing regarding gender differences, especially in terms of environmental knowledge (Echavarren, 2023; Langeheine & Lehmann, 1986) and hunger (Benton, 2015). Thus, gender becomes crucial in examining the interaction between knowledge of environmentally friendly foods and hunger on individual portion sizes.

To the best of the researcher's knowledge, there are few studies examining the influence of knowledge of environmentally friendly foods and hunger on portion sizes, especially in Indonesia. The researchers also identified weaknesses in the methods used in previous research, which were subjective (Polivy & Herman, 2017). Therefore, this study will use an objective measuring tool, namely behavioral measurement. This strengthens the rationale for conducting this research. Hence, this study aims to further investigate the influence of gender on knowledge of environmentally friendly foods and hunger on portion sizes. The researchers assume that individuals with good environmental knowledge will choose ideal portion sizes, even when hungry.

Method

Design

The present study employed quantitative and quasi-experimental methods with a post-only control group design, incorporating a manipulation setting within a controlled environment. Participants were permitted to select their own food in a controlled setting, with the objective of observing natural food choice behaviour. The primary aim of the study was to assess the effect of environmental food knowledge and hunger on portion size based on gender in a realistic yet controlled scenario. The controlled setting ensured consistency in the environment, thereby minimising the influence of external factors that may potentially influence food choice.

Participants

The population consists of active students from State Universities in Indonesia, aged 17 to 25 years, recruited through pamphlet distribution on social media platforms (Instagram, WhatsApp, and Twitter). The minimum sample size required is N=107, calculated using G Power 3.1.9.4 (Faul et al., 2009). Sampling technique involves purposive sampling with criteria excluding individuals on specific diets (vegan, vegetarian), or with allergies or food intolerances. Participants should not have formal training in environmental science or related fields.

Procedure

Before the experiment, participants provide informed consent and are briefed on the tasks involved. Demographic measurements such as weight, gender, and height are recorded. Participants rate their hunger levels and complete the questionnaire on knowledge of environmentally friendly foods. During the interactive phase, participants select food items using the FFB according to typical meal times (breakfast and lunch). Choices made by participants are documented for portion size evaluation. Participants receive a souvenir as a reward. All participants are debriefed about the study's objectives after the experiment. Ethical approval for this research has been granted by the Research Ethics Commission of Universitas Negeri Semarang under number [095/KEPK/FK/KLE/2024].

Measurements

The study includes an interactive component with a Fake Food Buffet (FFB), composed of 24 items (Bucher et al., 2012). The validity of the FFB ranges from 0.76 to 0.87, with item reliabilities for carrots (0.79), nuts (0.81), pasta (0.89), and chicken (0.77). The FFB is used to measure portion sizes by quantifying the total amount of food selected. Knowledge of environmentally friendly foods is assessed using a 16-item instrument adapted from Hartmann et al. (2021), translated into Indonesian through back-to-back translation. This instrument has validity ranging from 0.23 to 0.45 and reliability of 0.77. Hunger levels are measured on a 1–5 scale (Very Not Hungry – Very Hungry).

Data Analysis

This study employed descriptive analysis to summarise and describe the extant data. The data was then tested using SPSS 25.0 with the general linear model univariate method with an effect size of d=0.15, α=0.05, power=0.95.

Results

In this chapter, the results of the participants' demographic data, descriptive statistics, and the results of the general linear model univariate method test will be presented.

Table 1.
Participant Characteristics (n = 123)

Characteristics	n	%
Gender		
Female	75	61%
Male	48	39%
Body Mass Index		
Underweight	29	23,6%
Ideal	76	61,8%
Overweight	15	12,2%
Obese	3	2,4%

Participants in this study are students from State Universities, totaling 123 participants. The composition is 61% female and 39% male. BMI values were measured based on participants' weight and height. Results show that 61.8% of participants have a normal BMI.

Table 2.
Descriptive Statistics Data (n=123)

Variable	n	Mean	Std. Deviation
Gender			
Female	75	5.7500	3.08599
Male	48	5.4894	3.52551
Total	123	5.6504	3.24917
EFK	123	7.3089	3.07323
Portion Size	123	5.6504	3.24917
Hunger	123	3.0081	1.11249

*EFK= Environmental Food Knowledge

Descriptive Statistics above indicate that for females (M=5.7500, SD=3.08599) and males (M=5.4894, SD=3.52551). This shows that the mean for females is higher than males. However, the standard deviation for males is higher than females. These data explain that the participants' knowledge of environmentally friendly foods tends to be high (M=7.3089, SD=3.07323). Participants tend to choose larger portion sizes in this study (M=5.6504, SD=3.24917). The research findings also show that participants were hungry (M=3.0081, SD=1.11249).

Table 3.
Test of between-subjects effects

Sources	B	p-value	Partial Eta Squared
Female	-10.819	.012	.054
Male	0[a]	.	.
EFK	-.641	.101	.023
Portion Size	-1.062	.258	.011
EFK X Hunger	.187	.122	.021
Female X EFK	1.497	.005	.067
Male X EFK	0[a]	.	.
Female X Hunger	3.085	.013	.052
Male X Hunger	0[a]	.	.
Female X EFK X Hunger	.429	.008	.060
Male X EFK X Hunger	0[a]	.	.

*EFK = Environmental Food Knowledge

Based on the table above, the detailed results of this study indicate that for females, p= .012, η^2p = .054. This means that females tend to take smaller portion sizes compared to males. However, females with good knowledge of environmentally friendly foods tend to take larger portion sizes, p= .005, η^2p = .067. When hungry, females also tend to take larger portion sizes, p= .013, η^2p = .052, whereas males exhibit the opposite trend. The research findings also show that females with good knowledge of environmentally friendly foods, when hungry, tend to take larger portion sizes compared to males, p= .008, η^2p = .060.

Discussion

The findings of this study confirm that women with good knowledge of environmentally friendly foods and in a hungry state tend to have larger portion sizes compared to men. This interaction can be explained through the Knowledge-Attitude-Behavior (KAB) theory developed by Erwin P. Bettinghaus (1986). According to this theory, behavior change is influenced by individual knowledge and attitudes (Schneider & Cheslock, 2003). When individuals possess good knowledge of environmentally friendly foods and are faced with hunger, it can result in either positive or negative attitudes towards the intended behavior. These attitudes emerge as a consequence of the hunger experienced by individuals.

When someone feels hungry, their body undergoes hormonal changes that can intensify negative emotional reactions (Xu et al., 2015). In women, these emotional reactions are stronger and more intense (Deng et al., 2016), attributed to differences in how the female and male brains respond to internal and external signals related to hunger and food. Research conducted by the Brookhaven National Laboratory (2009) using Positron Emission Tomography (PET) scans indicated that when asked to control food cravings, women's brain activity in areas controlling food motivation and emotional regulation remains high, while in men, brain activity can significantly decrease (Wang et al., 2009). This suggests that men have better control over hunger. Therefore, physiological and psychological factors resulting from hunger can override the knowledge held, impacting different behaviors between men and women.

Furthermore, the study shows that men with knowledge of environmentally friendly foods tend to have smaller portion sizes compared to women. This finding aligns with previous research indicating that men generally have higher levels of environmental knowledge compared to women (Langeheine & Lehmann, 1986; Tikka et al., 2000), translating into better implementation into behavior. This is reflected in the portion sizes chosen by male participants as ideal.

However, women with good knowledge of environmentally friendly foods tend to have larger portion sizes. Clearly, knowledge does not always translate into aligned behavior; many factors influence consistency or change in eating habits (Harguess et al., 2020; Kaiser & Fuhrer, 2003; Valli et al., 2019). Additionally, improving attitudes is necessary to enhance desired behaviors. No matter how extensive one's knowledge is, without positive attitudes, its influence on behavior will be limited (Akhtar et al., 2014; Green et al., 1980). Thus, mediators such as behavioral intention, values, and attitudes are essential in aligning knowledge with behavior.

The study also confirms that women in a hungry state tend to have larger portion sizes compared to men. This interaction can be explained through the Cannon-Bard theory (1927). This theory asserts that emotions are the result of physical reactions to stimulating events. In the context of hunger, the body produces cortisol and adrenaline hormones that easily trigger the emergence of negative emotions (Dror, 2014). In such conditions, specific types of foods (carbohydrates, sweets, high-fat foods) can provide comfort when consumed and alleviate negative emotions (Duhita & Wulandari, 2023; Macht & Mueller, 2007; Massey & Hill, 2012; Parker et al., 2006; Yen et al., 2010). These emotions lead women in a hungry state to take larger portion sizes without considering what foods and how much they are consuming. This phenomenon is also supported by studies demonstrating that increased negative emotions such as stress can lead to larger portion sizes in women but not in men (Ackermans et al., 2022; Lim et al., 2018).

However, without considering knowledge of environmentally friendly foods and hunger, women tend to have smaller portion sizes compared to men. Women may restrain themselves from certain foods more than men due to concerns about their appearance (Chambers et al., 2008). Additionally, physiologically, men generally have much higher energy needs compared to women (Klausen et al., 1997), reflected in the larger portion sizes consumed by men.

Conclusion

This study investigates the influence of environmentally friendly food knowledge and hunger on portion sizes from a gender perspective. The results show that gender, environmentally friendly food knowledge, and hunger together have a positive and significant influence on portion sizes. From a moderation effect perspective, women with good environmentally friendly food knowledge take larger portion sizes compared to men. When hungry, women also take larger portion sizes than men. This applies similarly to women with good environmentally friendly food knowledge and in a hungry state. However, without considering environmentally friendly food knowledge and hunger, women have smaller portion sizes compared to men. This may be due to factors such as behavioral intentions, values, and attitudes. Therefore, future research should revisit these factors. Moreover, considering portion sizes are external factors that can be modified, it is important to educate the public about appropriate portion sizes and

more environmentally friendly choices. Other strategies could involve serving smaller portions when eating at home.

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Conflict of Interest
The researchers declare that this paper has no conflicts of interest.

Author Contribution
All authors have contributed equally to the study's conceptualization, interpreting data, reviewing, and editing the manuscript.

Data Availability
Data can be provided upon request to the author.

Declarations Ethical Statement
The study followed the guidelines of the Declaration of Helsinki.

Informed Consent Statement
Informed consent was obtained from all persons involved in the study.

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