ASSOCIATION OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS BASED ON BODY MASS INDEX (BMI) OF WOMAN IN SURAKARTA, CENTRAL JAVA, INDONESIA

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ABSTRACT

Background: Household food security has been associated with households's ability to access sufficient food to meet the needs of all family members. This study aims to determine the association between household food security and nutritional status based on BMI in women aged 15–49 in Surakarta, Central Java, Indonesia.
Method: This research used a cross sectional design. 101 women were included as subjects by the random sampling technique. Food security data was obtained from HFIAS (Household Food Insecurity Access Scale) questionnaire and nutritional status was measured using BMI. Statistical tests to determine the association between variables use the Spearman correlation test and the Pearson correlation test.
Result: The research results showed p = 0.328, which means there was no association between income and nutritional status based on BMI, and showed p = 0.004 which means there was an association between income and household food security, and p = 0.677, which means there was no association between household food security and nutritional status based on BMI.
Conclusion: There was no association between household food security and nutritional status based on BMI of women in Surakarta, Central Java, Indonesia.

Keywords: Body Mass Index, Food Security, Household, Nutritional Status, Woman

INTRODUCTION

According to Food Law Number 18 of 2012, household food security is a condition where household food needs are met, which is reflected in the availability of sufficient food, both in quantity and quality, that is safe, equitable, and affordable. Household food security has been related to the household's ability to access sufficient food to meet the needs of all family members. Household food security was reflected by several indicators, including: (1) level of damage to crops, livestock and fisheries, (2) decline in food production, (3) level of food availability in the household, (4) proportion of food expenditure to total expenditure, (5) fluctuations in prices of the main foods commonly consumed by households, (6) changes in social life, such as migration, selling or mortgaged assets, (7) food consumption conditions in the form of eating habits, quantity and quality of food, and (8) nutritional status (Rachman & Ariani, 2016).

Nutritional status was influenced by some factors, such as intake and utilization of nutrients in the body. Dietary patterns and family food security were closely related to nutritional intake (Andrianary & Antoine, 2019). There was a group that is vulnerable to nutritional problems is women, because they are expectant mothers (Angraini, 2018). Women are vulnerable to nutritional disorders and are at risk of Chronic Energy Deficiency (CED) which can cause low birth weight (LBW) babies (Shalrmal, 2013). Based on Primary Health

Research (Riset Kesehatan Dasar) data in 2013 shows that prevalence of CED among women in Indonesia was 20.8%. Women of reproductive age between 15-49 years (Isti A, et al., 2019). CED for women has a negative impact on themselves and the next generation. (Septiani et al., 2021). Based on Indonesian Ministry of Health (Kementrian Kesehatan RI) data in 2014 show that BMI measures can monitor the nutritional status of women, with a normal BMI limit and a tolerance of 10%. Nutrition problems in Indonesia are related to family food security (Supriasa, et al., 2013). Based on Food Security Agency (Badan Ketahanan Pangan) data in 2015 show that 17.4% of Indonesia's population classified as being in the very food insecure category, and 48.86% is in the food insecure category. Based on Indonesian Ministry of Agriculture (Kementrian Pertanian) data in 2022 show that food security index score in Surakarta City in 2019 was ranked 47th, decreased to 48th in 2020, and again decreased to 53rd in 2021 out of 98 cities in Indonesia recorded in the 2022 Food Security Statistics Book. This shows that food security in the city of Surakarta is an unresolved problem because it has decreased from year to year.

There are challenges that arise in efforts to achieve equitable food security in Indonesia, as seen in population growth. The most challenging efforts are increasing urbanization and managing population growth. According to this problem, food insecurity in urban areas have to threats seriously to the realization of national food security (Suryana, 2014). An increased population with imbalanced food supplies, will impact food insecurity in the future. Providing sufficient food is one of the main efforts to achieve an optimum nutritional status. The higher the family's food availability, the more the family's nutritional adequacy would increase. (Faiqoh et al., 2018). According to National Development Planning Agency (Badan Perencanaan Pembangunan Nasional) data in 2018 show that food security factor that influences CED conditions is people's access to nutritious food.

Research conducted in Bandar Lampung City shows that food security as measured using the Household Food Insecurity Access Scale (HFIAS) questionnaire is related to the incidence of stunting in toddlers (Wardani, et al., 2020). Research in Semarang City shows that measuring food security including food availability, food access and food utilization is related to the incidence of stunting in toddlers aged 24-59 months (Faiqoh, et al., 2018). Additionally, it was demonstrated in a study by Singh (2014) that found a association between women's nutritional status and household food security.

Based on this background, this research aims to determine the association between household food security and nutritional status based on BMI of woman in Sangkrah and Semanggi Village, Surakarta, Central Java, Indonesia.

METHOD

This observational study utilized a cross-sectional approach to collecting the primary data. The data was obtained through questionnaires that assessed respondent characteristics, household food security, and nutritional status based on BMI. The sampling method used in this study was random sampling, from a population of 1917 obtained sample subjects in total 101 respondents who were a woman who lived in Sangkrah and Semanggi Village, Pasar Kliwon District,

Surakarta, Central Java, Indonesia, were married and had child, were willing to be research respondents proven by signing the inform consent. The exclusion criteria for this study were that the respondent was pregnant, was sick when the data collection took place, was consuming medication which could affect the measurement of nutritional status, the respondent withdrew during the data collection process, did not fill out the questionnaire completely.

Data on the characteristics of the respondents (woman who lived in Sangkrah and Semanggi Village, Pasar Kliwon District, Surakarta, Central Java, Indonesia, were married and had child, were willing to be research respondents proven by signing the inform consent) were taken using a questionnaire. Nutritional status data was obtained from measuring body height using a microtoice and body weight using a scale with an accuracy of 0.1 cm. The data obtained is used to calculate BMI, namely with the formula body weight (kg) divided by body height (m) squared. Then the resulting values are divided into deficient nutritional status (BMI <18.5 kg/m^2) and non-deficient nutritional status (BMI ≥ 18.5 kg/m^2).

Data of household food security was obtained directly through interviews using the HFIAS (Household Food Insecurity Access Scale) questionnaire by FANTA III which has been validity tested and reliability tested by Wollo University and Addis Ababa University (2018) with a Cronbach's alpha value is 0.926. HFIAS measuring the ability level of households to fulfill their need in the last 30 days. In HFIAS, respondents were given nine questions related to food insecurity with responses of "Yes" or "No". Households with "Yes" responses further answered the frequency of occurrence (rarely scored 1, sometimes scored 2 and often scored 3). The "No" responses were scored as 0. The value for each respondent would be in the range of 0 to 27. Food security categorized into food secure household (scored 0-1) and food insecure household (scored 2-27)

Data analysis was performed using SPSS version 20, with the Kolmogorov-Smirnov test for normality and the Pearson correlation test to assess the association between household food security and nutritional status based on BMI. This research has received ethical approval issued by the Health Research Ethics Commission (KEPK) from Faculty of Health Sciences, University of Muhammadiyah Surakarta with license number 229/KEPK-FIK/III/2024.

RESULTS AND DISCUSSION

3.1. Respondent Characteristics

The characteristics of those selected to participate in this study are presented in Table 1.

3.1.1. Age

Age is one of the variables that can influence food security status both on an individual and household scale. The age of women in the reproductive age range can affect their food security in consideration of nutritional needs was changed during the reproductive cycle (Sugianti, et. al., 2023). The age of the respondents in this study can be seen in Table 1.

Based on Table 1, it is known that the distribution of respondents based on age is higher in the 21 to 35 year age group with 67 people (66.3%), and the lowest age distribution is in the 46-49-year-old age group, with 4 people (4%). Research conducted by Sugianti, et. al. (2023) stated that food insecurity in Lamongan Regency was dominated by young adults aged <35 years.

Table 1. Respondent Characteristics

Respondent Characteristics		Total	
		n	%
Age	21-35	67	66,3
	36-45	30	29,7
	46-49	4	4
Job of Head of Household	Laborer	28	27,7
	Private sector employee	33	32,6
	Trader	13	12,9
	Civil servants	5	5
	Self-employed	22	21.8
Income	< 2.269.070 IDR	79	78.2
	> 2.269.070 IDR	22	21.8
Food security household	Food insecure household	45	44,6
	Food secure household	56	55,4
Nutritional Status based on BMI	Malnutrition	7	6.9
	Normal	58	57.4
	More Nutrition	36	35.6
Total Per Item		101	100

Source: Primary data (2024)

Research conducted by Elsahoryi, et. al. (2020) also found that respondents aged between 18-30 years were at higher risk of having food insecurity compared to those aged over 45 years.

3.1.2. Job of Head of Household

The main job is the job of the head of the household as the main source of household income. An overview of the job of the head of the respondent's household can be seen in Table 1.

Based on Table 1, it can be seen that the largest occupation of the head of the household of the respondents is as a private employee with 33 people (32.6%) and followed by employees who work as laborers with 28 people (27.7%), while the job of the head of the respondent's household is at least 5 people are civil servants (5%). This is in line with research conducted by Sutomo, et. al. (2014), who stated that the majority of jobs from the City of Surakarta are private employees. The research he conducted also showed that these two occupations had a percentage of food secure households twice as high as those experiencing food insecurity.

Based on research conducted by (Sutomo et al., 2014) the level of food security in Surakarta City is lowest among laborers. This is in line with research conducted by (Hidayat, A. & Utami, D., 2019) which states that if a family has a job other than a worker, they generally have an income that exceeds that of a worker and are able to be 1.06 times better food secure. This could be because the wages received as laborers are lower than other job groups.

3.1.3. Income

Income is an important component in the economy. This income can indicate the level of welfare of a household. Consumption of goods can also change at any time according to the income received. The income of respondents in this study can be seen in Table 1.

Based on Table 1, it was found that the majority of respondents had incomes below IDR 2.269.070 as many as 79 people (78.2%) and income above IDR 2.269.070 as many as 22 people (21.8%). Most of the respondents had an income in the category less than the City Minimum Wage (CMW) for Surakarta City in 2024, namely IDR 2,269,070. Upadhyay and Pathania (2013) state that the greater the level of income, the higher the level of expenditure on consumption. Research conducted by (Hidayat, A. & Utami, D., 2019), found a association and influence of family income above the CMW on household food security status.

His research shows that the percentage of food insecure households because they have incomes below the CMW reached 68.7%. Meanwhile, the percentage of food secure households because they have income above the

CMW reached 77.6%.

3.1.4. Household Nutrition Food Security

Household food security is the ability of a family to consistently and adequately obtain and access sufficient, safe, nutritious and hygienic food to meet nutritional needs and daily life (Yustika Devi et al., 2020). The food security category is divided into two, namely food insecurity and food security. The distribution of respondents based on household nutritional food security can be seen in Table 1.

Based on Table 1, it shows that respondents with food security in the food insecure category were 45 people (44.6%). Then there were 56 respondents in the food secure category (55.4%). Based on the Food Security Agency (2017), Central Java Province is ranked 9th in the incidence of food insecurity. Research by Hidayat, A. & Utami, D., (2019) also conveys several determinant factors of food insecurity. The decline in food security in households was influenced by family income, number of nuclear family members, education, and the occupation of the head of the family who works or does not work in the agricultural sector.

Based on Table 2, it shows that description of respondents' responses to household food security variable items in Sangkrah Village and Semanggi Village were obtained, namely that the percentage of respondents who answered "no" was above the average of 50%. This data confirms that Sangkrah Village and Semanggi Village do not experience food shortages or insecurity. This is also in line with Prasetyo's (2013) research conducted in Semanggi and Sangkrah Districts. In his research, a review of household food security was carried out based on the percentage of food expenditure method, and the research results showed that the food security status of the two sub-districts was classified as good (78.9%).

In this questionnaire, it is known that the average percentage of respondents who answered "yes" reached 13.7%. Statements of concern regarding food access are still in the range above 10%, emphasizing the need to evaluate determinant factors regarding households that are still worried about not having enough food in the last 1 month. In general, economic problems such as income are a fundamental factor in nutritional problems and food insecurity (Wardani et al., 2020).

Food availability in the household can be defined as an indicator of the quality, quantity and safety of food available in the household (Jayarni & Sumarmi, 2018). The availability of family food greatly influences the consumption level of family members, including women who are classified as vulnerable groups (Verawati et al., 2020). In the HFIAS questionnaire used, the household food availability domain is at points 1-3. On these three points, there are more "Yes" answers than on other points. So it can be seen that, evaluating food security based on the HFIAS questionnaire, the study population has food insecurity in the domain of food availability at the household scale (Utami & Sisca, 2015).

The next domain based on the household scale food security evaluation using HFIAS is the low quality and variety of food ingredients in the household. This domain can be represented by questions in points 4-6. When compared with the previous domain, limited variety and quality of food ingredients has a smaller number of "Yes" indicators (Coates, et. al., 2007). The most common impact of

food insecurity due to a lack of quality food variety is micronutrient deficiencies. Research conducted on adult women on the American continent showed that the impact of food insecurity due to a lack of variety of food ingredients was a deficiency in iron, vitamin D and vitamin A (Lopes, et. al., 2023; Jun, et. al., 2021).

Table 2. Description of Respondent's Responses to Household Food Insecurity Access Scale

	Question Items	Answer			
		No		Total Yes	
		n	%	n	%
1	In the last four weeks, have you been worried that you household didn't have enough food?	67	66.3	34	33.6
2	In the last four weeks, have you or anyone in your household been unable to eat the types of foods you enjoy due to a lack of resources?	79	78.2	22	21.8
3	In the last four weeks, have you or anyone in your household had to eat a less varied foods due to lack of resources?	81	80.2	20	19.8
4	In the last four weeks, have you or anyone in yout household had to consume food that didn't want to eat because of a lack of resources to obtain other types of food?	87	86.1	14	13.8
5	In the last four weeks, did you or any member have to consume a little meal than you needed because don't have enough food?	86	85.1	13	12.8
6	In the last four weeks, have you or someone in your household had to eat little portions than you needed because don't have enough food?	91	90.1	10	9.9
7	In the last four weeks, have you ever been do not have any food in the house due to lack of resources from getting any food?	99	98	2	1.9

The final domain for evaluate household food security with the HFIAS questionnaire is lack of food intake and/or accompanied by consequences of decreased physical abilities (Coates, et. al., 2007; Utami& Sisca, 2015). Based on Table 2, it is known that this domain is represented by questions in points 7-9. The decrease in "Yes" statements by respondents, when compared to the other two domains, is an indicator of minimal lack of intake which can affect the physical abilities experienced by the study population. In points 8-9, there are questions with fairly similar phenomena description conditions. However, the condition that often occurs is in question point 8, namely as many as 19.9% of households experience hunger at night due to a lack of food sources that must be consumed. Research conducted by Osei, et. al. (2023), stated that conditions of food insecurity by not consuming food, especially at night in adolescents, contribute to various psychological disorders, sleep disorders, and decreased performance in learning activities at school. So, it is necessary to take further intervention steps regarding food availability which can be discussed with related parties.

3.1.5. Nutritional Status of Women of Childbearing Age based on BMI.

Based on Table 1, it shows that 7 women respondents with poor

nutritional status (6.9%), 58 respondents with normal nutritional status (57.4%), and respondents with more nutritional status were 36 people (35.6%). Research conducted by (Wardle et al., 1997), the nutritional problems experienced by women in Benin City since 2015-2017 have changed quite significantly. In 2015, it was found that the prevalence of women experiencing malnutrition based on BMI was quite high. However, as time goes by, there are changes in nutritional problems, namely women often experience overnutrition. In 2017, it was found that the prevalence of women experiencing underweight was 9.5%, while women experiencing overnutrition reached more than three times the magnitude of the problem of undernutrition (31.7%). The results of this research also have relevance to the research conducted. In this study, the nutritional problems of women who experienced over-nutritional status were five times greater than those of women who experienced less nutritional status.

Research conducted in 2016 showed that being overweight affects around 1.9 billion (39% of the total population) adult women, 650 million of whom are obese (NCD-RisC, 2016). Various countries in Asia have experienced economic growth and demographic transition over the past few years. In low-middle income countries, the transition also has an impact on the country's health epidemiology. These changes reduced the prevalence of undernutrition and increased the prevalence of overweight or obesity among women in Asia (Lancet, 2017).

Research conducted by Ferdausi et al., (2022) revealed that there is a association between food insecurity and the incidence of obesity in low-income communities. The results of the research reveal that adults who are food insecure are 61% more likely to be obese than food secure adults. The study of (Pan et al., 2017) conducted on women in South America revealed that the reason for this incident was the factor of consuming foods high in sugar and fat and energy dense. Consumption patterns of low-cost and energy-dense foodstuffs can be a determining factor in the occurrence of obesity.

3.2. Association Income and Nutritional Status based on BMI

Based on the Spearman test table, it was found that p-value = 0. 328 (p>0.05), with the results that there was no association between household income and nutritional status of women based on BMI. This is contrary to research conducted by (Xin & Ren, 2021). His research states that there is a significant association in a positive direction between household income and nutritional status based on BMI among elderly people in rural areas of the Republic of China. The results of the analysis of the association between household income and nutritional status based on BMI can be seen in Table 3.

Table 3. Association Income and Nutritional Status based on BMI

Income	Nutritional Status based on BMI				Total		*P-value*
	Malnutrition		Not Malnutrition				
	n	%	n	%	n	%	
< 2.269.070 IDR	6	7.6	73	92.4	79	100	
> 2.269.070 IDR	1	4.5	21	95.5	22	100	0.328
Total	**7**	**6.9**	**94**	**93.1**	**101**	**100**	

Source : Primary data (2024)

Table 4. Association Household Nutritional Food Security and Income

Income	Household Food Security				Total		*P-value*	OR 95% CI
	Food Secure Household		Food Insecure Household					
	n	%	n	%	n	%		
< 2.269.070 IDR	39	49.4	40	50.6	79	100	0.004	0.287 (0.096 -0.853)
> 2.269.070 IDR	17	77.3	5	22.7	22	100		
Total	56	55.4	45	44.6	101	100		

Source : Primary data (2024)

Table 5. Association Household Food Security and Nutritional Status based on BMI

Household Food Security	Nutritional Status based on BMI				Total		*P-value*
	Malnutrition		Not Malnutrition				
	n	%	n	%	n	%	
Food Secure Household	5	4.95	51	50.50	56	100	0.677
Food Insecure Household	2	1.98	43	42.57	45	100	
Total	**7**	**6.93**	**94**	**93.07**	**101**	**100**	

Source : Primary data (2024)

The association between household income and nutritional status can be very complex and influenced by various factors. In general, low household income can be a risk factor that causes a lack of access to nutritious food and healthy eating patterns, which in turn can contribute to poor nutritional status. Low income can limit an individual's or family's ability to afford nutritious foods that are essential for healthy growth and development. This can cause an unbalanced diet and nutritional deficiencies (Afifah et al., 2022; Xin & Ren, 2021).

In this study, it was found that there was no association between household income and the nutritional status of women based on BMI. This is in line with research conducted by (Edwards et al., 2021). In his research, several causes of anomalies in the association between income and nutritional status based on BMI were explained. The results of this research are supported by Tirthani, et. al. (2023), metabolically, genetic and epigenetic variations contribute to nutritional status based on BMI by influencing the function of metabolic pathways in the body and regulating nervous pathways and appetite centers. If the reaction to increased appetite is responded to well and balanced with intake that suits one's needs, it will minimize a person's experience of malnutrition.

Research conducted by Gambua, et. al. (2023), stated that the government of the Surakarta City Food Security and Agriculture Service has carried out community empowerment and food utilization through urban farming efforts and assistance from Sustainable Food Yards (SFY). The implementation of this empowerment in Surakarta recorded 26 groups spread across 5 sub-districts in Surakarta. The largest distribution of SYF is in Banjarsari District with 8 groups because the Banjarsari District area is the largest sub-district area in Surakarta. Implementation of urban farming and SYF recipients in Surakarta City are spread across Gilingan, Joglo, Banyuanyar, Kadipiro, Manahan and Banjarsari subdistricts. The results of this horticultural cultivation are able to produce household and market-oriented food products in urban areas due to easy access, so they are able to contribute to supporting food availability in the city of Surakarta (Gambua, et. al., 2023).

3.3 Association Income and Household Nutritional Food Security

The results of the analysis of the association between household income and household nutritional food security can be seen in Table 4. Based on the results of the Spearman test table, p-value = 0.004 (p<0.05), so there is a association between income and household nutritional food security. In this statistical test, a correlation coefficient was obtained with a value of -0.3, with the degree of association being classified as weak (Hulu & Sinaga, 2019). The negative direction of the correlation interprets that the lower the income, the higher the food security status score based on HFIAS, which has a higher chance of experiencing food insecurity. These results are in line with research conducted by Annisa, et. al (2022) on the population of Lamongan Regency and research by Chinnakali, et. al. (2014) in the Indian population.

The odds ratio (OR) result was 0.287 (95% CI 0.096 - 0.853) indicating that income <2.269.070 IDR can increase the risk of food insecurity in households compared to income >2.269.070 IDR. So, it can be seen that income above the minimum wage can significantly be a protective factor against food insecurity. Based on the research results, it was found that there was a significant association household income and food security, accompanied by results of income less than the minimum wage, a 29% higher risk of occuring food insecurity in terms of percentage. Household income has a close association with food security. Food security refers to the ability of individuals or households to access sufficient, nutritious and safe food to consistently meet their nutritional needs (Drammeh, et. al., 2019).

Research conducted by Annisa, et. al. (2022) identified various determinant factors that cause the association between income and household nutritional food security. In his research conducted on the subject of agricultural areas, it was stated that the determinant factors underlying low food security include low family income, home areas that make it difficult to access shopping places, and low education of the head of the family or mother in the nuclear family. So it can be seen that the factor that plays the most role in regional food security is food accessibility which refers to distance and access to food or physical access, as well as people's purchasing power or economic access (Food Security Agency, 2019). Low household income which can refer to poverty is an economic problem that is often the main problem of various nutritional problems, especially in developing countries (UNICEF, 1998).

Bartfld & Dunifon's (2016) research also found that macroeconomic factors such as low average wages, low participation in food and nutrition assistance programs, high unemployment rates, residential instability, and high tax burdens increase the likelihood of food insecurity in households that have children. Research conducted by Ribar & Hamrick (2014) suggests that several factors that cause low income and poverty can influence food insecurity, namely changes in many families living in the same house without fully sharing resources, and unexpected economic needs (for example, unexpected medical expenses).

Limited of household income or below the poverty line condition, allowing family members, especially those who play a core role in distributing family food such as mother, to make difficult decisions that can result in food supplies becoming inadequate (Wight, et. al., 2015). Inadequate food supply over a sustained period of time can result in inadequate energy intake which can lead to malnutrition in each family member.

Malnutrition in women is a risk that often occurs when households experience food insecurity. This is because women as a nuclear family and acting as mothers, psychologically will prioritize the needs of other family members (Delisle, 2018).

Women have a double vulnerability to malnutrition, because of their high nutritional needs in some conditions, as well as because of the gender gap in poverty. Undernutrition and overnutrition occur simultaneously in developing countries experiencing rapid nutritional transitions, and women are vulnerable to the double burden of "disnutrition", which is often the accumulation of stunting or micronutrient malnutrition combined with obesity or other chronic nutrition-related diseases (Delisle, 2015). If sustainable intake is inadequate for women because they experience food insecurity, it will result in other nutritional problems such as the risk of Chronic Energy Deficiency (CED) in pregnant women, stunting, and other nutritional problems (Delisle, 2018; Petrika, 2014).

In this study, there are differences in the results of the interpretation of the association between household income and food security. Based on the results, a significant association was found between household income and food security, accompanied by income less than the minimum wage, a 29% higher risk of experiencing food insecurity as a percentage. However, based on the actual percentage of food security scores for all respondents, it is dominated by respondents who are food insecure. Meanwhile, looking at the income aspect, we found a dominance of respondents who had household incomes below the minimum wage. Research by Srivastava and Muhammad (2022) suggests that this event can occur because all aspects that can support food security conditions are fulfilled, namely food access, food availability and food utilization. His research also revealed that food insecurity conditions that occur in society generally occur in areas that are difficult to reach, such as rural areas (41.2%). Meanwhile, urban areas have fewer food insecurity conditions (38%), because they have easier access to food.

Conditions for maintaining community food security are one form of achieving the Sustainable Development Goals (SDGs) which are being pursued by all countries, to achieve zero hunger by 2030 (Pérez, 2017). Various policies implemented by the Indonesian Government have been attempted to achieve food security in Indonesia, especially urban areas which have a rapidly increasing population. Several efforts have also been made by the Central Java Provincial Government, and efforts currently being made include increasing Expected Food Patterns (EFP), setting the Highest Retail Price (HRP) to protect consumers and farmers, improving infrastructure, and providing food twice as much as needed. , especially in rice as the main food commodity (Nurdin & Nadia, 2022).

Various efforts have been made by the Surakarta City Government, which may be the cause of the high food security score in the study population, even though at the same time it was found that household income was lower than the set minimum wage. This effort has proven effective in reducing food insecurity in the city of Surakarta. Due to these efforts, Surakarta City has the best score as a city/district that has a food availability score (100.0) and food affordability score (100.0), as well as the second highest food utilization (88.7) in Central Java Province (BPS Central Java Province, 2020; Badan Ketahanan Pangan, 2018).

3.4 Associstion Household Nutritional Food Security and Nutritional Status based on BMI

The results of the analysis of the association between household income and nutritional status based on BMI can be seen in Table 5. Based on the Pearson test table, the p-value = 0.677 (p>0.05), with the result that there is no association between food security and women nutritional status based on BMI. These results contradict research conducted by Rajabzadeh, et. al. (2023). That research reveals that there was a significant association between high rates of food insecurity and low BMI of women on a household scale. This is because the nutritional condition of mothers, women and children is an appropriate index for surveying overall community health and the status of food security in families. Alemayehu, et. al. (2015) stated that insufficient calorie intake in the long term can affect the quantity and quality of breast milk and cause malnutrition in the baby to be born. Malnutrition of mothers and children is a serious public health problem and is responsible for 45% of child deaths. Therefore, the mother's diet must have sufficient calories and nutrients.

In the research conducted, it was found that there was no association between household food security and nutritional status based on BMI. In Table 5, it can be seen that 44.55% of the research population's households experienced food insecurity. So it can be seen that the majority of the study population is in a condition of food security (55.45%). Furthermore, in the table it can be seen that women who are in the underweight BMI category have a greater percentage in the food secure group. According to research conducted by Jomaa, et. al. (2020), food insecurity has a negative correlation with low BMI values in women. However, it has a positive correlation with the incidence of obesity on a household and female scale.

Research conducted on mothers as women in Lebanon shows that families who experience food insecurity are at high risk of experiencing obesity because they do not implement a varied and varied diet (Jooma, et. al., 2017). A meta-analysis study showed that adults in food insecure families, especially women, are more at risk of obesity and also concluded that the risk of weight disorders may increase with the level of food insecurity and is not related to low BMI (Moradi, et. al. , 2019). Meanwhile, in this study, the BMI group was not classified into the obesity category as an abnormal group, allowing for an anomalous bias in the association between low BMI and the incidence of food insecurity on a household scale.

Research conducted by Ferdausi, et. al. (2022) revealed that there is a correlation between food insecurity and the incidence of obesity in low-income communities. The results of the research reveal that adults who are food insecure are 61% more likely to be obese than food secure adults. The study of Pan, et. al. (2017) conducted on women in South America revealed that the reason for this incident was the factor of consuming foods high in sugar and fat and energy dense. Consumption patterns of low-cost and energy-dense foodstuffs can be a determining factor in the occurrence of obesity.

Various studies reveal the association between food insecurity mechanisms and high BMI values in women. Several studies have revealed that inadequate resources in a household make women mothers not prioritize purchasing food that has good nutritional value, especially for themselves. Women who lack resources may purchase and consume cheaper

energy-dense foods, such as refined grains, sugar, and fat to prevent hunger, or avoid fruits and vegetables because they are unaffordable (Kowaleski, et. al ., 2019; Mohammadi, et al., 2014).

Pan, et. al. (2017) revealed that food insecurity in households has a higher prevalence of obesity. Several studies have revealed the mechanism by which food insecurity causes obesity. First, food insecure individuals may overcompensate when food is available resulting in greater overall food intake. For example, research finds that food expenditure and energy intake increase drastically after food stamps are received. Cyclical food restriction is associated with increased body fat, decreased lean body muscle mass, and faster weight gain (Townsend, 2014).

Second, weight cycling due to food insecurity can make the body use food energy more efficiently, such as increasing body fat storage in response to food shortages (Drewnowski & Specter, 2014). Third, energy-dense foods, such as foods high in sugar and fat, are often cheaper. Food insecurity is associated with low food expenditure, low fruit and vegetable consumption, and unhealthy eating patterns. Excessive consumption of low-cost, energy-dense foods can result in increased energy intake and lead to obesity. Lastly, food insecurity is associated with negative psychological consequences, such as anxiety and depression, regardless of socioeconomic status; some of these negative consequences can also lead to obesity (Lindsey P Smith, 2013).

In Table 5, it is found that the percentage of food insecure households is in women with a BMI of 'Not Undernourished'. The number of women reached 42.57%. Ribeiro, et. al. (2016) stated that food insecurity often occurs in households as a condition of uncertainty or limited availability of nutritious food or the inability to obtain safe and acceptable food. In addition to hunger resulting from insufficient food intake, food insecurity also includes poor food quality and worry or anxiety about securing food supplies. Food insecurity in households does not only impact physical health, but also psychologically affects household members.

The results of the analysis of qualitative findings in research in Afghanistan show that food insecurity in households is based on deep-rooted poverty and unfair gender norms. This factor causes high levels of food insecurity among family members, especially women (Gibbs, et. al., 2018). Several other impacts caused by food insecurity on female family members, especially women, are emotional changes, anxiety to depression, and changes in behavior in social relationships. Seturahman, et. al. (2016) revealed that food insecurity which has an impact on psychological disorders in women is generally caused by restrictions from the head of the family regarding how much money can be allocated for purchasing food, their control over women's access to nutrition. Davis & Kostick (2018) revealed that this pattern is the cause of more malnutrition among women than men in households.

Food insecurity, which often occurs in women, not only affects the deaths of infants and toddlers, but more broadly also contributes to several diseases such as hypertension, diabetes and heart disease. Several studies reveal that 20% of households with women and other family members experiencing food insecurity will experience chronic disorders such as hypertension, diabetes and heart disease. Other research also revealed that 13% of women who were classified as having food insecurity in their households were detected as

having mental health disorders. Apart from that, other research also suggests a relationship between food insecurity and cognitive impairment in women and children (Soraya et al., 2017)

Rising food prices are the factor that has the biggest impact on food insecurity. Incidents of rising food prices have occurred in several countries with various inflation factors since 2007. Rising food prices and the economic crisis have had a major impact on food security and nutrition because this will increasingly push the most vulnerable households into poverty and weaken their ability to access sufficient food. On the other hand, the factors behind the high and unstable food prices are the lack of investment in agriculture and the lack of attention to issues of food security and nutrition as well as the suffering of small-scale farmers, especially in agro-ecological areas where many people experience poverty (Gustafson , 2016).

According to the Food Security Agency (2017), the very food insecure category is based on food consumption in the consumption category < 70% of the RDA (Recommended Daily Allowance). The value of meeting energy consumption is symbolized in the form of average calories per day, then compared with an individual's needs based on age. Based on the results of research conducted by Saputro (2021), 67% of households in the city of Surakarta consume enough energy and do not experience food insecurity. So it turns out that the percentage of households that consume less than their needs is 33%. However, this target has not yet reached the population that meets the Energy Adequacy Rate (EAR) set by the Surakarta City Government (98.40%).

Some of the food sources that dominate consumption in Surakarta City are rice with the highest demand, corn, cassava, and several other types of food ingredients (Saputro, 2021). There are several efforts that are often made to ensure food availability and avoid food insecurity. The Surakarta City Government has made several efforts, including holding 7 cheap markets, procuring 25 tons of rice, and procuring 31 tons of rice for food insecure residents (Surakarta City Agriculture and Food Security Servic, 2023).

The availability of food is an illustration of the use of food availability for public consumption, grains are still the largest. The cause of this phenomenon is the expensive source of animal protein. Thus, the Surakarta City government is increasing the availability of high biological value protein or animal protein. One of the efforts made to increase food security for protein foods is the Cheap Food Movement (GPM) which is part of organizing cheap markets. This movement is able to bring in egg materials from breeders directly. The hope of this effort is to provide cheap prices for the community to access food and reduce the level of food insecurity in the community (Surakarta City Food Security and Agriculture Service, 2023).

CONCLUSION

There was no association between income and nutritional status based on BMI of woman in Sangkrah and Semanggi Village, Surakarta, Central Java, Indonesia. There is a association between household nutritional food security and income in Sangkrah and Semanggi Village, Surakarta, Central Java, Indonesia. There is no association between household nutritional food security and nutritional status based on BMI of woman in Sangkrah and Semanggi Village, Surakarta, Central Java, Indonesia. This research

recommends for the comunnity to paying attention to household expenditure by placing greater emphasis on fulfilling nutrition and increasing household food security to enhance the health of the family. Suggestions for future researchers are that they can continue research by increasing literature studies on each variable by paying attention to other determinant factors that may occur in research.

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