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Impact of Calorie Intake on Cardiovascular Disease Risk Factors for Young Adults Working from Home During the COVID-19 Pandemic

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Abstract: During the COVID-19 pandemic, working from home (WFH) led to increased passivity, potentially affecting body mass index (BMI), waist circumference (WC), and blood pressure (BP) values, which are risk factors for cardiovascular disease (CVD). This study aimed to determine the impact of calorie intake on these risk factors in young adults working from home during the COVID-19 pandemic. This experimental study employed a one-group pre- and post-test design conducted over two months. Respondents' daily physical activities were recorded using Bouchard's questionnaire, and a food record method was used to document all foods consumed over three days. The study followed up with respondents for two months. The results indicated that respondents with good physical activity levels experienced a decrease in BMI: 53.3% of men and 37.5% of women. Adequate calorie intake also contributed to a decrease in BMI, with 53.3% of men and 57.1% of women showing reductions. However, the t-test showed p-values >0.05 for the correlations between calorie intake and BMI, WC, systolic blood pressure (SBP), and diastolic blood pressure (DBP). In conclusion, there was no significant impact of calorie intake on risk factors for CVD, such as obesity and high blood pressure. Nonetheless, it was observed that appropriate calorie intake could potentially prevent the increase of these risk factors.
Keywords: calorie intake; cardiovascular disease; COVID-19 pandemic

INTRODUCTION

Coronavirus disease pandemic (COVID-19) was firstly reported in Wuhan, Hubei Province, China, and then expanded all over the world.[1] Indonesia reported the first COVID-19 case in March 2, 2020, as many as two cases.[2] Transmission from human to human is the main spread of this disease, progressing very quickly. Therefore, to break the chain of transmission of the spread of the COVID-19, the government implemented the large-scale social restrictions (LSSR) program in various regions in Indonesia listed in the Minister of Health Regulation Number 9 of 2020. These social restrictions forced various sectors, especially companies and educational institutions, to implement a work from home (WFH). Physical activity (PA) during WFH is undoubtedly different from the exact activities as usual.[3,4] In addition, the LSSR also temporarily closed various public areas and made regulation of social distancing. This caused a reduction in activities especially body movement.[5]

Regular physical activity has a beneficial effect on health, such as in the case of cardiovascular disease (CVD). The CVD risk factors are associated by body mass index (BMI), waist circumference (WC), and blood pressure (BP) values.[3,6-7] Individuals with lower PA levels are likely to have a 20-30% risk of early death.[8] Furthermore, staying at home for long periods can cause additional stress and interfere with people's mental health, which can increase appetite and calorie intake.[9]

Calorie intake (CI) is defined as the amount of energy consumed through food and drink. A calorie is a unit of energy defined as the heat energy required to raise 1 gram of water by 1°C. Another definition of a calorie is a unit that measures energy in food and energy produced, stored, and used by living organisms.[10] The choice of calorie intake alone or in combination with an unhealthy lifestyle can increase the incidence of CVD. The prevalence of CVD risk factors in Indonesia in 2018 was very high among men and women aged ten years and over. The most important risk factors are smoking, less PA, obesity, and hypertension, ranging from 28 to 33%.[11,12] Mathew et al[13] stated that CVD is closely related to an increase in BMI, WC, and BP, which are major problems worldwide that cause high mortality and morbidity. Individuals following a calorie restriction regimen result in a decrease in total cholesterol, low-density cholesterol (LDL), total cholesterol to high-density cholesterol (HDL) ratio, triglycerides,[14] fasting glucose, fasting insulin, CRP, as well as systolic and diastolic blood pressures.[15] At the same time, higher LDL levels will occur in the group with high-calorie intake.[16] Therefore, the aim of this study was to determine the impact of calorie intake on risk factors for cardiovascular disease in young adults with WFH during the COVID-19 pandemic.

METHODS

This was an experimental study using one group pre- and post-test design in the morning for two months from November 2020 to the end of December 2020. The determination of the respondents in this study was carried out using a purposive sampling method with a total of 50 young adult respondents around age 23-25 years old who were in WFH during the LSSR period in the COVID-19 pandemic and domiciled in Greater Jakarta (Jakarta, Bogor, Depok, Tangerang, and Bekasi). Respondents were selected based on inclusion criteria with an online google forms questionnaire. This research has passed the ethical review of the Research Ethics Committee of the YARSI University Research Institute with letter number No: 055/KEP-UY/BIA/II/2021.

The measurements were carried out at the home of each respondent, considering the LSSR in the COVID-19 pandemic era. Therefore, researchers visited the respondent's residences one by one daily during two months of research while still paying attention to protocols and health standards during the COVID-19 pandemic. Then, the measurements of BMI, WC, and BP pre-test values would be carried out in the first week, followed by the respondent doing daily PA during WFH, the data of which were in the Bouchard questionnaire. Measurement of CI using the food record method for three days in 24 hours (two weekdays and one weekend) was followed up for two months to monitor the total CI online using the fat secret application. The results were

evaluated whether they were included in the deficient, balanced, or excess CI.

Measurement of BMI was carried out using the formula for the body weight (BW) in kilograms (Kg) divided by body height (BH) in square meters (m2). Body-weight measurement used a digital weight measurement tool. The BH was measured using a stadiometer where the measurement results in women with healthy BMI between 18–22.9 Kg/m2, and in men of 18-24.9 Kg/m2. Measurement of WC using a tape measure by measuring the midpoint of the distance between the top of the iliac crest and the bottom of the last rib (costae 12) in a horizontal plane parallel to the umbilicus. It is said that the average WC in Asian women is <80 cm, while in men <95 cm.[10] The BP measurement was done by placing a cuff on the right upper arm with the arrow pointing to the brachial artery using a digital sphygmomanometer with normal measurement result <120/80 mm Hg.

Bouchard questionnaire method was divided into good PA, namely, energy expended 150 minutes/week or more in moderate-intensity or 3.5-7 kcal/day, and less PA, namely energy expended <150 minutes/week in moderate-intensity or 3.5 kcal/day. Meanwhile, CI results were divided into deficient if the energy consumed was <70% of the total body requirement. Meanwhile, balanced or good CI was the amount of energy consumed was 70-80% of the total body requirement, and in the excess CI if the calories consumed were >80% of the total body requirement.[5]

There were many shortcomings due to the limitations of the researcher who played a role in the insignificant results. The number of respondents tended to be small due to time and cost reasons. In addition, in this study, there were several things that the researchers could not control, such as individual variations, the respondent's calorie intake, and the duration and hours of sleep of the respondents that might affect the results on the variables. The pandemic situation limiting social activities resulted in researchers not following up on respondents directly.

RESULTS

Table 1 showed the distribution of respondent characteristics. Based on sex, female respondents were predominant (56%) meanwhile based on age, 22 years were the most frequent for both sexes (45.5%).

Table 1. Distribution of respondent characteristics

Characteristics of respondents	Total (n)	Percentage (%)
Sex		
Male	22	44
Female	28	56
Total	50	100
Age		
Male		
21 years	1	4.5
22 years	10	45.5
23 years	7	31.8
24 years	4	18.2
Total	22	100
Female		
21 years	6	21.4
22 years	9	32.1
23 years	9	32.1
24 years	3	10.7
25 years	1	3.6
Total	28	100

Table 2 showed the description of PA during LSSR in young adults with WFH. Most of the respondents had adequate PA, as many as 15 male respondents (68.2%) and 14 female respondents (50%).

Table 2. Description of PA during the LSSR for young adults WFH

Physical activity	**Male**		**Female**	
	Total (n)	Percentage (%)	Total (n)	Percentage (%)
Adequate	15	68.2	14	50
Excess	7	31.8	14	50
Total	22	100	28	100

Table 3 showed that eight males (53.3%) and females (57.1%) with adequate CI experienced a decrease in BMI. There were also four males (26.7%) and a female (7.1%) with adequate CI experienced an increase in BMI. However, three males (20%) and five females (35.7%) had adequate CI and did not experience any change in BMI. Furthermore, two males (42.9%) and four females (28.6%) with excess CI experienced a decrease in BMI. There was also a male (14.3%) and six females (42.9%) with excess CI experienced an increase in BMI. Meanwhile, there were three males (42.9%) and four females (28.6%) who had excess CI and did not experience any change in BMI. The statistical test showed that no significant meaning between the levels of CI and BMI of male (p=1.000) and female (p=0.334) young adults with WFH. The result suggested that there were individual variations and measurement limitations during lockdown with little contact. Moreover, the detailed type of food was not recorded during the whole experiment and the sum of calories intact was within the daily recommended.

Table 3. The correlation between CI and changes in BMI during the LSSR in young adults WFH

Sex	**Calorie intake**	**Changes in BMI**						**Total**		**p-value**
		Decrease		Constant		Increase				
		(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	
Male	Adequate	8	53.3	3	20	4	26.7	15	100	
	Excess	2	42.9	3	42.9	1	14.3	7	100	1.000
	Total	10	45	6	27.3	6	27.27	22	100	
Female	Adequate	8	57.1	5	35.7	1	7.1	14	100	
	Excess	4	28.6	4	28.6	6	42.9	14	100	0.334
	Total	12	42.9	9	32.1	7	25	28	100	

Table 4 showed that there were ten males (66.7%) and six females (42.9%) with adequate CI experienced a decrease in WC. There were also three males (20%) and two females (14.3%) with adequate CI experienced an increase in WC. However, there were two males (13.3%) and six females (42.9%) who had adequate CI and did not experience any change in WC. Furthermore, two males (28.6%) and five females (35.7%) with excess CI experienced a decrease in WC. There were also four males (57.1%) and five females (35.7%) with excess CI experienced an increase in WC. Meanwhile, there were a male (14.3%) and four females (28.6%) who had excess CI and did not experience any change in WC. The statistical test showed no significant meaning between the levels of CI and WC in male (p=0.493) and female (p=0.905) young adults with WFH. The types of calorie intake in this study were recorded only three days a week so that no food could reach in detail. Due to time constraints, the measurement of WC might need to be revised.

Table 5 showed that three males (42.9%) and four females (28.6%) with adequate CI experienced a decrease in SBP. There were also two males (13.3%) and two females (14.3%) with adequate CI experienced an increase in SBP. However, there were ten males (66.7%) and eight females (57.1%) who had adequate CI and did not experience any change in SBP.

Furthermore, three males (20%) and two females (14.3%) with excess CI experienced a decrease in SBP. There were also two males (28.6%) and two females (14.3%) with excess CI experienced an increase in SBP. Meanwhile, there were two males (28.6%) and ten females (71.4%) who had excess CI and did not experience any change in SBP. The statistical test showed that no significant meaning between the level of CI and SBP in male (p=0.964) and female (p=0.999) young adults with WFH. Alteration of SBP was statistically non-significant; likewise, the value of SBP was within the standard limit at the preliminary and post-experiment levels.

Table 4. The correlation between CI and changes in WC during LSSR in young adults WFH

Sex	Calorie intake	Changes in WC						Total		p-value
		Decrease		Constant		Increase				
		(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	
Male	Adequate	10	66.7	2	13.3	3	20	15	100	
	Excess	2	28.6	1	14.3	4	57.1	7	100	0.493
	Total	12	54.5	3	13.6	7	31.8	22	100	
Female	Adequate	6	42.9	6	42.9	2	14.3	14	100	
	Excess	5	35.7	4	28.6	5	35.7	14	100	0.905
	Total	11	39.3	10	35.7	7	25	28	100	

Table 5. The correlation between CI and changes in systolic blood pressure (SBP) during LSSR in young adults WFH

Sex	Calorie intake	Changes in SBP						Total		p-value
		Decrease		Constant		Increase				
		(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	
Male	Adequate	3	42.9	10	66.7	2	13.3	15	100	
	Excess	3	20	2	28.6	2	28.6	7	100	0.964
	Total	6	27.3	12	54.5	4	18.2	22	100	
Female	Adequate	4	28.6	8	57.1	2	14.3	14	100	
	Excess	2	14.3	10	71.4	2	14.3	14	100	0.999
	Total	6	21.4	18	64.3	4	14.3	28	100	

Table 6, there were a male (14.3%) and six females (42.9%) with adequate CI experienced a decrease in DBP. There were also six males (40%) and two females (14.3%) with adequate CI experienced an increase in DBP. However, eight males (53.3%) and six females (42.9%) had adequate CI and did not experience any change in DBP. Furthermore, there were a male (6.7%) and four females (28.6%) with excess CI experienced a decrease in DBP. There were also three males (42.9%) and four females (28.6%) with excess CI experienced an increase in DBP. Meanwhile, there were three males (42.9%) and six females (42.9%) who had excess CI and did not experience any change in DBP.

Table 6. The correlation between CI and changes in diastolic blood pressure (DBP) during LSSR in young adults WFH

Sex	Calorie intake	Changes in DBP						Total		p-value
		Decrease		Constant		Increase				
		(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	
Male	Adequate	1	14.3	8	53.3	6	40	15	100	
	Excess	1	6.7	3	42.9	3	42.9	7	100	1.000
	Total	2	9.1	11	50	9	40.9	22	100	
Female	Adequate	6	42.9	6	42.9	2	14.3	14	100	
	Excess	4	28.6	6	42.9	4	28.6	14	100	0.999
	Total	10	35.7	12	42.9	6	21.4	28	100	

The statistical test showed no significant meaning between the levesl of CI and DBP of male (p=1.000) and female (p=0.999) young adults with WFH. Such as the alteration of SBP and DBP is statistically non-significant; likewise, the value of DBP is within the standard limit at preliminary and post-experiment.

DISCUSSION

The results found that most of the respondents have adequate PA, as many as 15 male respondents (68.2%) and 14 female respondents (50%) (Table 2). Ekelund's study[17] showed no relationship between PA and BMI. According to Chaput,[10] PA was not the main factor influencing changes in body weight, but good PA was consistently more influential in preventing chronic diseases, especially CVD. Ruegsegger and Booth[6] stated that lack of PA could have effects such as visceral obesity, hypertension, dyslipidemia, chronic proinflammatory, hyperglycemia, and obesity. Insulin resistance is a risk factor for chronic diseases such as type 2 diabetes mellitus (T2DM), CVD, and others.[18-20] In contrast, Jalal et al[21] stated a significant relationship between PA and BMI changes,[22] and an increase in WC in respondents with less PA,[23] especially during the COVID-19 pandemic. Furthermore, research by Dyck[24] stated that adults who did moderate-to-heavy PA regularly with a duration of 150 minutes/week reduced the risk factors for CVD by as much as 12%. However, further increases in physical activity beyond this level did not have any additional effect.[25]

During WFH, a person tends to be more passive in all activities at home, causing laziness and increasing the risk of increased CI or overfeeding. These factors can affect the risk of CVD. Several things make researchers quite surprised by the results of this study. In the BMI examination conducted on female respondents, it was found that there was a sufficient trend of CI according to the recommendations that could reduce and/or stabilize BMI in 57.1% of respondents (Table 3). These results are in line with the literature which explains that good eating habits are obtained as long as the total calories consumed every day are limited according to the target so that weight gain that affects BMI can be prevented while avoiding obesity.[11,26] This finding is not the same as male respondents with excess CI who could lower and/or stabilize their BMIs (42.9%). Moreover, this result is not in line as a study that says that excessive CI can increase postprandial oxidative stress, which abnormally increases blood glucose, free fatty acid, and triglyceride levels circulating in the blood which can ultimately lead to obesity and hyperglycemia.[10]

Interviews conducted by researchers revealed that respondents with excess CI but experienced a decrease in BMI balanced their lifestyle by doing enough PA, or even excess PA, such as doing heavy intensity PA every day. This suggests that physical activity played an important role in counteracting the potential negative effects of high calorie intake on BMI. In addition, this is following Rashidi's statement[27] that an increase in energy expenditure such as PA can affect a person's body weight.[22] This result is not in line with Cardenas' opinion[28] stating that several randomized trials proved that PA without dietary intervention did not affect BMI and WC values. The combined effect of low CI with short-term PA provides greater benefits in reducing visceral fat for 12 weeks.[7] These results show the same results as Brown's study[29] which described that adults who have a poor ability to estimate the energy expended during PA and energy intake from calorie intake, which affects weight management.

Someone tends not to be concerned about calorie intake after strenuous exercise.[29] Based on the findings of the research conducted, there was an increase in BMI in respondents with excess CI (Table 3). The high BMI was closely related to the negative impact of the risk of premature death in CVD, including hypertension, hyperlipidemia, insulin resistance, and oxidative stress. On the other hand, a low-calorie and high-fiber diet intervention by a group of individuals with a BMI >30 kg/m^2 who was followed up for 5 years could reduce the incidence of coronary heart disease by 30%. In addition, the benefits of limited calorie intake and the selection of high-fiber and low-fat foods are they can reduce BP, blood lipid levels, inflammation, and oxidative stress.[30]

The results of this study indicate that sufficient CI and following the recommendations tend to reduce WC, both in male and female respondents (Table 4). This is as mentioned in several works of literature explaining that excess CI can increase body weight (BW), affecting BMI and WC.[27] This was also in line with Ashtary-Larky et al's study[31] which proved that the slow decrease in BW was caused either by improper diet patterns or excess calorie intake could increase WC. Measurement of WC has been reported as a reasonable predictor of major metabolic disorders. An important assessment of BW is performed on general adiposity and abdominal fat, which is often associated with increased health risks. The increase in excess body weight which can increase the risk factors for metabolic diseases such as T2DM, CVD, and obesity is mostly caused by an excessive increase in CI, in addition to genetic factors and congenital diseases.[32]

This study found insignificant results regarding the effect of CI level on systolic and diastolic BPs in young women and men working from home (Table 5 and 6). However, clinically, there was a higher percentage decrease in systolic and diastolic BPs in respondents with sufficient CI and an increase in systolic and diastolic BP in respondents with excess CI. Research conducted by Nicoll[33] states the same thing, that weight loss by limiting calorie intake was not associated with a decrease in BP. This condition is caused by calorie restriction which involves an electrolyte imbalance in the content of each food which will change the BP balance in the kidneys.[34] However, modification of calorie intake is one effective way to control BP which is in line with the results of a study that all calorie restriction interventions had an positive impact, and there was a decrease in systolic BP of 3.07 mmHg and diastolic of 1.81 mmHg.[27,35] The literature explained a correlation between calorie intake and an increase in BP caused by high salt levels and high-calorie foods; this could trigger hypertension accompanied by obesity where these two factors were the most common causes of CVD.[24]

CONCLUSION

Based on statistical analysis, calorie intake had no significant influence on risk factors for CVD, including BMI, WC, and BP values in young adults working from home during the COVID-19 pandemic. However, trends observed in the data suggest that clinically, adequate calorie intake may contribute to preventing CVD by potentially reducing these risk factors.

Further research is needed to explore factors such as sleep duration, hormonal changes, and other variables that may influence calorie intake and its relationship with CVD risk factors. A more comprehensive understanding of these factors will provide deeper insights into the mechanisms affecting CVD risk in young adults working from home.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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