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Weight cycling among Indonesian college students in West Java province during the COVID-19 pandemic

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ABSTRACT

Introduction: Changes in our bodies can cause several problems, particularly for students who are concerned about maintaining an ideal body shape. Many of them try to diet, but their body returns to its previous weight or even increases in weight. Thus, this study aimed to determine the factors that influence the incidence of weight cycling in Indonesian students during the COVID-19 pandemic. **Methods:** This cross-sectional study used purposive sampling to collect data. Three hundred college students from West Java province, Indonesia, participated. Weight cycling was the dependent variable and the independent variables were physical activity, sex, and weight management. Multivariate logistic regression analysis was used to determine the factors influencing the incidence of weight cycling. **Results:** Sex, physical activity, skipping meals, and snacking were determinants related to weight cycling incidence. Females had a 0.7 times higher risk of experiencing weight cycling than males. Inactive students were 4.7 times more likely to become weight cyclers, and those who rarely skipped mealtime had lower risk of being weight cyclers. Students who sometimes and always consumed snacks had higher risk of becoming weight cyclers by 3.3 and 2.7 times, respectively, compared to those who rarely consumed snacks. **Conclusion:** Regular physical activity, not skipping meals, especially breakfast, and practising a healthy diet every day are recommended strategies to avoid weight cycling during a pandemic.

Keywords: dietary habits, physical activity, weight cycling, weight management

INTRODUCTION

Changes in body shape frequently result in many individual problems. One of the most significant issues confronting young adults over the age of 18 years related to body weight. The response behaviour is to pay attention to changes in body shape with the goal of making it look ideal (Stavridou *et al.*, 2021). Many young adults engage in dieting without considering the nutritional composition of the food they consume. They diet to appear attractive and be accepted by their friends. A strict diet, such as eating once a day without consulting a doctor or nutritionist, is one of the diets that jeopardises health. Many people who start a diet only think about how to get thin quickly and easily without considering the effects of the diet (Tapsell *et al.*, 2016).

Weight cycling is a condition of losing weight after a diet, but then re-gaining weight rapidly, and repeatedly. The effects often occur in people who make frequent dietary changes. It can also

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occur if a young adult goes back to their previous eating pattern after reaching her ideal weight. This weight gain can return to the pre-diet weight; however, it can also be larger and lead to obesity. Obesity and its co-morbidities, such as cardiovascular disease, type 2 diabetes, and various types of cancer, are the main health issues to address because they are the leading global causes of death; thus, efforts must be made to minimise their prevalences. More than 1.9 billion adults were overweight or obese in 2016, yet efforts to combat obesity have mostly failed (Contreras, Schriever & Pfluger, 2019). The incidence of obesity has doubled in more than 70 nations in recent decades, and obesity cases have tripled among young people in many places, particularly in emerging and low-income countries such as China, Brazil and Indonesia (Pellegrini *et al.*, 2020).

Obesity develops as a result of a long-term imbalance between energy intake and production, leading to the accumulation of fat tissue. Weight loss is important in preventing disease complications. Successful weight loss is defined as a person voluntarily losing 10% of their initial body weight and maintaining it for a year (Contreras, Achriever & Pfluger, 2019). Although guidelines for recommending various types of weight loss have been developed, most are known to be effective only in the short term. Nearly 80% of obese people who intentionally reduced weight are likely to regain their previous weight within five years (Yumuk *et al.,* 2015). Weight cycling is defined as a 2.25 kg-10.00 kg or 5-10% fluctuation in body weight over one month or one year (Carey & Vitek, 2020).

Weight cycling is unlike weight change, in that it does not just measure changes in body weight during a diet; there is also further assessments of changes in weight before and after dieting. This is important because weight cycling can lead to obesity and can put individuals at a higher risk of future weight gain (Mackie, Samocha-Bonet & Tam, 2017).

Weight cycling has previously been seen in people with overweight and obesity issues who intended to go on a weight loss programme. However, it is becoming more prevalent in students with normal nutritional health who feel dissatisfied with their body shape and embark on a weight loss programme. In addition to body image, the COVID-19 pandemic has had an impact on students' lifestyles, activities and diet. College students are obliged to engage in more activities at home, which leads to an increase in sedentary behaviour, such as sitting, lying down, and playing video games (Alafif *et al.*, 2021). Since the pandemic, college students have been involved in extensive online learning activities, resulting in increased screen time, which leads to behavioural changes in weight control. Therefore, the objective of this study was to identify the factors associated with the occurrence of weight cycling among college students in West Java province, Indonesia, during the COVID-19 pandemic.

MATERIALS AND METHODS

Study population

The Ethics Committee of Universitas Gadjah Mada approved this study under the number KE/FK/0670/EC/2021. The inclusion criteria for the sample were: 1) college students above the age of 18 years; 2) college students living in West Java, Indonesia; and 3) college students who were still registered at the university. The exclusion criteria for this research sample were: 1) college students who had a history of diabetes mellitus or who were diagnosed with cancer; 2) college students who were pregnant; and 3) college students who did not respond to all questions in the questionnaire.

Sampling method

The sample size was determined using Cochran's formula for an unknown

population ($n=z^2pq/d^2$). On the basis of accuracy levels of d=0.05, q=0.5, p=0.5, and a 90% confidence interval (z=0.164), the required sample size for this study was 270. The study included 300 participants to overcome participant drop-out. The formula for adding the sample size was *n'=n/(1-f)*; *n'*: number of samples after revision, *n*: number of samples; and the estimated proportion of drop-outs as 10%.

Instrumentation

This research used a cross-sectional design, with structured questionnaires based on interviews. The reliability and validity of the questionnaires were validated in the Indonesian language. Before completing the questionnaires, the respondents signed an informed consent form as proof of their consent. Weight cycling, physical activity, and weight management behaviour were the variables measured in this study.

The incidence of weight cycling during the COVID-19 pandemic was divided into two categories: those who experienced weight cycling and those who did not experience weight cycling. Weight cycling was assessed using the questionnaire developed by Panarotto *et al.* (2014). It included respondents general data, such as sex and residence. To collect information about cycling of body weight, students were asked if they were in Indonesia during the COVID-19 pandemic, that was from 2 March 2020 to the time this research was carried out. To determine whether there was any fluctuation in their weight, the students were asked if they had experienced any weight gains after weight loss treatments. If they answered 'Yes' and it turned out to be an increase in weight of about 2.25 kg–10.00 kg, the student was categorised as a weight cyclist. This was in accordance with the statement by Carey & Vitek (2020) that someone can be regarded as a weight cyclist if they diet by intentionally reducing energy intake to lose weight, but once successful, regains weight by about 2.25 kg–10.00 kg or 5–10% of their initial body weight over one month or one year.

Weight management behaviour was measured using a questionnaire modified from Robinson *et al.* (2021), with each question item assessed using the following terms: 1= rarely, 2= sometimes, 3= often, and 4= always. A short version of the International Physical Activity Questionnaire (IPAQ) was used to assess the respondents' physical (Orcid & Orcid, 2020). There were two ways to measure scores on the Short-IPAQ: continuous scores and category scores. The category scoring technique used in this study divided physical activity into three categories: (1) category I/inactive, (2) category II/minimally active, and (3) category III/HEPA (health enhancing physical activity). These were defined as follows:

a. Category 1 (inactive) was the lowest level, comprising those who did not fit into the second and third categories.
b. Category II (minimum activity) comprised those with the lowest activity pattern that could be classified as sufficient activity. The criteria for inclusion were three or more days per week of vigorous activity for at least 20 minutes per day, five days or more of moderate intensity activity or walking 30 minutes per day, or five or more days of any combination of walking, moderate-intensity exercise and vigorous-intensity activities achieving a minimum of at least 600 MET-min/week.
c. Category III (HEPA) comprised those who did 1.5-2.0 hours of exercise per day with high intensity.

Data analysis

Data analysis was performed using IBM SPSS Statistics for Windows version 26 software (IBM Corporation, Armonk,

New York, USA). In addition, the validity of the questionnaires was tested using the Pearson Product Moment technique, while reliability was tested using Cronbach's alpha. All variables showed strong reliability test results: weight cycling variables (Pearson's R=0.824, p<0.05), physical activity variables (Pearson's R=0.764, p<0.05) and weight management behaviour (Pearson's R=0.684, p<0.05). Descriptive, bivariate, and multivariate study data processing were performed using STATA Statistical software: Release 17 (StataCorp LP, College Station, Texas, USA). The variables were subjected to bivariate analysis to identify independent variables that met the requirements for multivariate logistic regression analysis. Independent variables with p value <0.25 can be investigated further using a multivariate model.

RESULTS

Respondent characteristics

The findings showed that 61.3% of college students in West Java were not weight cyclists during the COVID-19 pandemic, while 38.7% of students were. Table 1 lists the factors associated with weight cycling. Most of the students (54%) who participated in this study were female, and nearly all lived with their parents or family (78%) during the pandemic from 2020 to 2021. Since the implementation of the large-scale social restriction policy (PSBB; *Pembatasan Sosial Berskala Besar*) by the Indonesian government, schools and other public facilities were closed to prevent the virus from spreading. It was found that most students (50.7%) did not engage in sufficient physical activity. The students' weight management habits were also poor during the pandemic, with 38.4% frequently skipping meals, 51.7% frequently consuming snacks, and 38.7% sometimes eating more food when stressed (Table 1).

Table 1. Socio-demographic background, dietary habits, and physical activity of the respondents (N=300)

Variable	*n (%)*
Sex	
Male	136 (45.3)
Female	164 (54.7)
Residence	
Family/ relatives	236 (78.7)
Dormitory	64 (21.3)
Physical activity	
HEPA	73 (24.3)
Minimum active	75 (25.0)
Sedentary	152 (50.7)
Skip mealtime	
Rarely	70 (23.3)
Sometimes	115 (38.4)
Often	79 (26.3)
Always	36 (12.0)
Taking dietary supplements	
Rarely	271 (90.6)
Sometimes	23 (7.7)
Often	0 (0.0)
Always	5 (1.7)
Snacking	
Rarely	75 (25.0)
Sometimes	70 (23.3)
Often	0 (0.0)
Always	155 (51.7)
Eating when stressed	
Rarely	101 (33.7)
Sometimes	116 (38.7)
Often	0 (0.0)
Always	83 (27.6)

HEPA: health enhancing physical activity

Bivariate analysis of factors related to weight cycling

According to the bivariate analysis (Table 2), only 28.7% of male students in this study experienced weight cycling during the COVID-19 pandemic. Weight cycling was more common among female students, with 47.0% engaging in weight cycling. According to the bivariate analysis, 61.4% of those who lived with their family did not experience weight cycling. The result was similar for those in student dormitories (60.9%). With regard to level of physical activity, 49.3%

of sedentary students experienced weight cycling, and 40.0% of students categorised as minimally active experienced weight cycling. Surprisingly, 15.1% of the physically active students also experienced weight cycling during the pandemic.

The results of the bivariate study on weight management behaviour factors, such as skipping mealtimes, consumption of dietary supplements, snacking, and eating while stressed, are shown in Table 2. The vast majority of the 300 students (77.1%) rarely skipped meals. College students who always skipped meals had higher risk of being weight cyclists (50.0%). Although most were found to rarely use dietary supplements, 47.8% occasionally did. Snacking was observed in 155 students, with 45.7% of weight cyclists snacking occasionally during the pandemic. Stress was a regular issue for college students during the pandemic, and most of the participants ate more to reduce their stress;38.6% of students ate more food whenever they were stressed, while 42.2% of weight cyclists consumed more food whenever they were stressed (Table 2).

Multivariate analysis of factors related to weight cycling

Following the bivariate analysis, sex, physical activity, skipping meals, and snacking were included in

Table 2. Bivariate analysis of independent variables related to weight cycling (*N*=300)

Variable	*Weight cycling n (%)*		*OR*	*95% CI*
	Yes	*No*		
Sex				
Male	39 (28.7)	97 (71.3)	1	
Female	77 (47.0)	87 (53.0)	2.2	1.3 – 4.6
Residence				
Family/ relatives	91 (38.6)	145 (61.4)	1	
Dormitory	25 (39.1)	39 (60.9)	1.0	0.8 – 3.2
Physical activity				
HEPA	11 (15.1)	62 (84.9)	1	
Minimum active	30 (40.0)	45 (60.0)	3.8	2.4 – 5.5
Sedentary	75 (49.3)	77 (50.7)	5.5	5.7 – 7.7
Skip mealtime				
Rarely	16 (22.9)	54 (77.1)	1	
Sometimes	46 (40.0)	69 (60.0)	2.2	0.9 – 3.5
Often	36 (45.6)	43 (54.4)	2.8	1.9 – 4.4
Always	18 (50.0)	18 (50.0)	3.4	1.3 – 5.9
Taking dietary supplements				
Rarely	102 (37.6)	169 (62.4)	1	
Sometimes	11 (47.8)	12 (52.2)	1.5	0.4 – 3.2
Always	2 (40.0)	3 (60.0)	1.1	0.2 – 3.5
Snacking				
Rarely	17 (22.7)	58 (77.3)	1	
Sometimes	32 (45.7)	38 (54.3)	2.9	0.9 – 6.2
Always	67(43.2)	88 (56.8)	2.6	0.5 – 6.7
Eating when stressed				
Rarely	41 (40.6)	60 (59.4)	1	
Sometimes	40 (34.5)	76 (65.5)	0.8	0.3 – 2.7
Always	35 (42.2)	48 (57.8)	1.1	0.4 – 3.4

HEPA: health enhancing physical activity

the multivariate analysis (p<0.25). The multivariate analysis aimed to determine which of the variables affected the incidence of weight cycling among students in West Java during the COVID-19 pandemic. According to the results of the multivariate analysis (Table 3), there was no interactions between the independent and covariate variables. Thus, the fit model shown in Table 3 was obtained. According to the results of the multivariate analysis, factors related to weight cycling were sex, physical activity, skipping mealtime, and snacking.

Table 3. Factors associated with the incidence of weight cycling among Indonesian college students (Fit Model)

Variable	*OR*	*95% CI*
Sex		
Male	1	
Female	1.9	0.6 – 4.3
Physical activity		
HEPA	1	
Minimum active	3.4	2.2 – 5.2
Sedentary	4.7	2.0 – 7.2
Skip mealtime		
Rarely	1	
Sometimes	2.2	0.8 – 3.4
Often	2.6	1.2 – 4.6
Always	2.7	1.8 – 5.2
Snacking		
Rarely	1	
Sometimes	3.3	1.2 – 5.7
Always	2.7	0.8 – 4.1

HEPA: health enhancing physical activity

Physical activity was the determinant variable of weight cycling, especially in sedentary (B:1.5) and minimally active (B:1.2) students. Sedentary students were 4.7 times more likely to become weight cyclists, and those who were slightly active had a 1.2 times higher risk of becoming weight cyclists than those who actively engaged in HEPA. The prevalence of weight cycling was also found to be affected by sex. Female students were 0.7 times more likely to become weight cyclists than male students.

Skipping meals was also associated with an increased risk of weight cycling among college students. When compared to those who rarely skipped meals, students who always skipped mealtimes had a 2.7 times greater chance of becoming weight cyclists, while students who frequently skipped mealtimes had a 2.6 times larger risk of becoming weight cyclists. College students who sometimes skipped meals were only 2.2 times more likely to become weight cyclists than those who rarely skipped meals. Similar results were found for the snacking habits of college students. Those who snacked sometimes and frequently had a 3.3 and 2.7 times higher risk, respectively, of becoming weight cyclists, compared with those who rarely snacked.

DISCUSSION

This study aimed to explore the phenomenon of weight cycling among college students and to identify the factors affecting weight cycling during the COVID-19 quarantine period from 2020 to 2021. According to the multivariate logistic regression analysis, sex, type of physical activity, skipping meals, and snacking were variables that predicted weight cycling among students. In this study, 39.7% of college students in West Java province, Indonesia, experienced weight cycling. A systematic scoping review published in 2021 indicated that during the COVID-19 pandemic, more than half of the young adult participants gained weight, while one-fifth lost weight (Chew & Lopez, 2021). Several studies have reported predictors of weight gain, including female sex (Di Renzo *et al.*, 2020), increased food consumption (Keel *et al.*, 2020), snacking after dinner (Zachary *et al.*, 2020), sedentary behaviour for six hours a day (Reyes-Olavarría *et al.*, 2020), and a lack of sleep at night (Zachary *et al.*, 2020).

Sex

In this study, women were shown to be 0.7 times more likely to suffer weight cycling than men. A study conducted in Saudi Arabia also found a significant correlation between sex and weight cycling. The number of female students who experienced weight cycling was higher than that of male students during the COVID-19 pandemic (Alafif *et al.*, 2021). Men are anticipatory when dealing with weight gain. For male students, social support from peers can act as a buffer against stress eating and weight increase. Adult women are known to be inclined to gain or lose weight repeatedly. A study of 167 obese women aged 18–60 years in the United States showed that 63% had experienced weight cycling and more than half had done so more than three times. They also have a higher BMI and maximum body weight than men (Darling *et al.*, 2017).

Women place such a high value on their appearance because they frequently experience low self-esteem and low physical satisfaction. There is significant difference in subjective perceptions of body image between sexes, with women demonstrating a higher disparity between real and perceived body image (Lôbo *et al.*, 2020). Moreover, overweight female students have a significantly higher prevalence of body image dissatisfaction (Ugelta *et al.*, 2022). There is more weight cycling among women, not only because of their body image, but also because women tend to be less eager to engage in physical activity than men. This fact is supported by data from the Basic Health Study conducted by the Indonesian Ministry of Health in 2018, which showed that around 36.4% of males and 30.7% of females over the age of 10 years engaged in insufficient physical activity (Ministry of Health of the Republic of Indonesia, 2018).

Physical activity

Physical activity was the most influential variable in the occurrence of weight cycling among the Indonesian students in West Java. The results of the multivariate regression analysis showed that students who had minimum physical activity habits had a 4.7 times greater risk of experiencing weight cycling than those who actively engaged in HEPA. A systematic review in 2019 reported that 89% of people who experienced weight cycling had strict commitment to performing high levels of physical activity and consuming low-calorie foods (Contreras, Schriever & Pfluger, 2019). The PSBB policy, which limited activities outside the home, altered the activity patterns of students, who were obliged to stay at home throughout the pandemic. Many studies found a decline in activity among teenagers and college students after the COVID-19 outbreak (Contreras, Schriever & Pfluger, 2019). Sedentary behaviour in college students changed during confinement due to the COVID-19 pandemic. Adults may have been forced to spend more time at home during this period of activity limitation, increasing the prevalence of sedentary behaviour (Romero-Balco *et al.*, 2020).

During the pandemic, the number of minutes per week spent engaging in moderate to vigorous physical activity significantly declined by about 20%, whereas time spent being inactive increased by three hours per day. Many students were forced to return to living with their parents and were forced to work from home, making access to sports facilities more challenging. The availability of sporting facilities such as gyms, fitness centres, swimming pools, and parks influences students' levels of physical activity (Bertrand *et al.*, 2021). College students can spend all day sitting in front of a computer, which can cause the abdominal muscles to soften and become distended. In addition, weight gain can be caused among students by eating unhealthy snacks while sitting in front of the computer and failing to engage in sufficient physical activity. The

World Health Organization recommends 150 minutes per week of exercise, which not only maintains the immune system and reduces stress from exhaustion or studying, but also helps maintain body weight (Ugelta *et al.*, 2022).

Skipping mealtime and snacking

In this study, weight cycling was found to be related to skipping meals and frequent snacking. Students who skipped meals consistently had a 2.7 times higher risk of weight cycling than those who skipped meals infrequently. Students who snacked frequently had a 2.7 times higher risk of weight cycling than students who seldom snacked.

Skipping meals is one of the behaviours that influences body weight. Research on those above 18 years of age has shown that those who skip meals have a higher body weight than those who do not. Young adults who skip breakfast consume an extra 193 kJ of energy at lunch. They also consume 114 kJ more at dinner when they just skip breakfast, 369 kJ more at dinner when they just skip lunch, and another 783 kJ at dinner when they skip both breakfast and lunch. Skipping meals (particularly dinner) reduces daily energy intake, but the reduction in daily diet quality (particularly when skipping breakfast) may negatively impact health over time. Skipping mealtimes, especially skipping breakfast, can cause overweight and obesity. This will undoubtedly increase the incidence of weight cycling (Zeballos & Todd, 2020).

Changes in eating habits, especially skipping meals and replacing them with snacks, are common in adults with stress or depression. Stress has also been associated with failure of weight loss programmes and high-calorie food consumption (Araiza & Lobel, 2018). Since the COVID-19 outbreak, many adults have felt significantly more anxious about being infected with the virus (Pellegrini *et al.*, 2020). Though the PSBB has prevented direct public interaction, yet many people have become stressed by the pandemic's boring routines at home (Hasanzadeh & Alishahi, 2020).

Several studies have investigated the association between the prevalence of weight cycling and stress (Quinn, Puhl & Reinka, 2020). It has been discovered that stress has an impact on an individual's food habits and exercise levels (Araiza & Lobel, 2018). Snacking and high-fat/high-sugar meals are frequently found in stressed adults (Silverman & Wang, 2021). One study found that during the pandemic, eating habits changed, with a 73% increase in eating when bored, a 65% increase in snacking after dinner, and a 73% increase in eating to satisfy food cravings. In 2020, a study on the Italian general population and students discovered new eating behaviours that resulted in a higher intake of "comfort foods" including chocolate, desserts, ice cream, and salty snacks (Scarmozzino & Visioli, 2020).

The PSBB altered the activity patterns of students, where they were obliged to stay at home. Online learning activities carried out by students during this pandemic also resulted in increased screen time and changes in weight management behaviour (Zachary *et al.*, 2020). Excessive weight gain can alter body composition and have an impact on a person's level of fitness, as well as their metabolic system (Carey & Vitek, 2020). Several methods may be used to maintain a healthy lifestyle and prevent weight cycling, including participation in regular physical exercise, not missing meals (particularly breakfast), and keeping a balanced diet. Exercise is fundamental for both burning calories and increasing the body's metabolism, both of which are essential for weight management and overall health (Ross *et al.*, 2020). Furthermore, a low-calorie, high-protein, and high-fibre diet should be considered; this can help prevent

overeating, since protein and fibre can help to reduce excessive appetite and produce a full stomach.

The limitation of this research is its cross-sectional design, which meant that it was not possible to evaluate cause and effect, and there was no information on food consumption patterns from the respondents. To fully understand the determining factors of weight cycling, other variables in eating behaviour should be included.

CONCLUSION

Many Indonesian students do not pay attention to the nutritional content of the food they eat when they go on a diet. Consequently, they go through a heavy cycle. Several factors can affect the onset of weight, including sex, physical activity, and skipped meals and snacks. Weight cycling needs to be avoided because it not only increases the risk of future weight accumulation, but also increases the risk of death, heart disease, and type 2 diabetes mellitus. Regular physical activity, not skipping meals (especially breakfast), and following a healthy diet every day are some strategies that are recommended to avoid becoming a weight cyclist.

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Authors' contributions

Mulyana B, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript and reviewed the manuscript; Fitrianingsih ADR, led the data collection, data analysis and interpretation, and reviewed the manuscript; Syihab SF, data interpretation, assisted in drafting of the manuscript, reviewed the manuscript; Novan NA, prepared the draft of the manuscript and took care of administration for research permits.

Conflict of interest

All authors declare that there is no conflict of interest.

References

Alafif NO, Abdelfattah EH, Al hadi RA, Alanazi SB, Alkabaa, RI, Alsalem FA, Aljeldah TM, Aldriweesh KK & Albati AA (2021). Effect of quarantine on eating behaviors and weight change among King Saud University students in Riyadh. *J King Saud Univ Sci* 33(8):101609. doi:10.1016/j.jksus.2021.101609.

Araiza AM & Lobel M (2018). Stress and eating: Definitions, findings, explanations, and implications. *Soc Personal Psychol Compass* 12(4):1–13. doi:10.1111/spc3.12378.

Bertrand L, Shaw KA, Ko J, Deprez D, Chilibeck PD & Zello GA (2021). The impact of the coronavirus disease 2019 (Covid-19) pandemic on university students' dietary intake, physical activity, and sedentary behaviour. *Appl Physiol Nutr Metab* 46(3):265–272. doi:10.1139/apnm-2020-0990.

Carey KJ & Vitek W (2020). Weight cycling in women: Adaptation or risk? *Semin Reprod Med* [Preprint]. doi:10.1055/s-0040-1721418.

Chew HSJ & Lopez V (2021). Global impact of covid-19 on weight and weight-related behaviors in the adult population: A scoping review. *Int J Environ Res Public Health* 18(4):1–32. doi:10.3390/ijerph18041876.

Contreras RE, Schriever SC & Pfluger PT (2019). Physiological and epigenetic features of yoyo dieting and weight control. *Front Genet* 10(December):1–12. doi:10.3389/fgene.2019.01015.

Darling KE, Fahrenkamp AJ, Wilson SM, Karazsia BT & Sato AF (2017). Does social support buffer the association between stress eating and weight gain during the transition to college? Differences by gender. *Behav Modif* 41(3):368–381. doi:10.1177/0145445516683924.

Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, Cinelli G, Leggeri C, Caparello G, Barrea L, Scerbo F, Esposito E & De Lorenzo A (2020). Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey. *J Transl Med* 18(1):1–15. doi:10.1186/s12967-020-02399-5.

Hasanzadeh S & Alishahi M (2020). COVID-19 pounds: Quarantine and weight gain. *SSRN Electronic Journal* [Preprint]. doi:10.2139/ssrn.3684120.

Keel PK, Gomez MM, Harris L, Kennedy GA, Ribeiro J & Joiner TE (2020). Gaining "The Quarantine 15:" Perceived versus observed weight changes in college students in the wake of COVID-19. *Int J Eat Disord* 53(11):1801–1808. doi:10.1002/eat.23375.

Lôbo ILB, Mello MT, Oliveira JRV, De CMP, Silva A & Guerreiro RC (2020). Rev Bras Cineantropom Hum university students. *Braz J Kinanthrop Hum Perform* 22(1):704–723.

Mackie GM, Samocha-Bonet D & Tam CS (2017). Does weight cycling promote obesity and metabolic risk factors?. *Obes Res Clin Pract* 11(2):131–139. doi:10.1016/j.orcp.2016.10.284.

Ministry of Health of the Republic of Indonesia (2018). Hasil Riset Kesehatan Dasar Tahun 2018 [2018 Basic Health Research Results]. *Kementrian Kesehatan RI* 53(9):1689–1699.

Orcid N & Orcid N (2020) 'Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF) as a measure of physical activity (PA) in young people with cerebral palsy : A cross-sectionl study', *Physiotherapy*, 107:209–215. doi:10.1016/j.physio.2019.08.013.

Panarotto D, Bosi GR, Neumann M, de Braga GL, Hickmann S & Marcki CR (2014). Reliability and internal consistency of questionnaire for evaluating weight cycling in Southern Brazil. *J Clin Nurs* 23(3–4):385–393. doi:10.1111/jocn.12021.

Pellegrini M, Ponzo V, Rosato R, Scumaci E, Goitre I, Benso A, Belcastro S, Crespi C, De Michieli F, Ghigo E, Broglio F & Bo S (2020). Changes in weight and nutritional habits in adults with obesity during the "lockdown" period caused by the COVID-19 virus emergency. *Nutrients* 12(7):1–11. doi:10.3390/nu12072016.

Quinn DM, Puhl RM & Reinka MA (2020). Trying again (and again): Weight cycling and depressive symptoms in U.S. adults. *PLoS ONE* 15(9 September):1–10. doi:10.1371/journal.pone.0239004.

Reyes-Olavarría D, Latorre-Román PÁ, Guzmán-Guzmán IP, Jerez-Mayorga D, Caamaño-Navarrete F & Delgado-Floody P (2020). Positive and negative changes in food habits, physical activity patterns, and weight status during covid-19 confinement: Associated factors in the chilean population. *Int J Environ Res Public Health* 17(15):1–14. doi:10.3390/ijerph17155431.

Robinson E, Boyland E, Chisholm A, Harrold J, Maloney NG, Marty L, Mead BR, Noonan R & Hardman CA (2021). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. *Appetite* 156:104853. doi:10.1016/j.appet.2020.104853.

Romero-Balco C, Rodriguez-Almaro J, Onieva-Zafrea MD, Laura PFM, Prado-Laguna del C & Hernandez-Martinez A (2020). Physical activity in university students around COVID-19 confinement. *ClinicalTrials.gov* 2117(December 2020):105802.

Ross R, Chaput JP, Giangregorio LM, Janssen I, Saunders TJ, Kho ME, Poitras VJ, Tomasone JR, El-Kotob R, McLaughlin EC, Duggan M, Carrier J, Carson, Chastin SF, Latimer-Cheung AE, Chulak-Bozzer T, Faulkner G, Flood SM, Gazendam MK, Healy GN, Katzmarzyk PT, Kennedy W, Lane KN, Lorbergs A, Maclaren K, Marr S, Powell KE, Rhodes RE, Ross-White A, Welsh F, Willumsen J & Tremblay M (2020). Canadian 24-hour movement guidelines for adults aged 18-64 years and adults aged 65 years or older: an integration of physical activity, sedentary behaviour, and sleep'. *Appl Physiol Nutr Metab* 45(10)S57–S102. doi:10.1139/apnm-2020-0467.

Scarmozzino F & Visioli F (2020). Covid-19 and the subsequent lockdown modified dietary habits of almost half the population in an Italian sample. *Foods* 9(5):675. doi:10.3390/foods9050675.

Silverman JR & Wang BZ (2021). Impact of school closures, precipitated by COVID-19, on weight and weight-related risk factors among schoolteachers: A cross-sectional study. *Nutrients* 13(8):2723. doi:10.3390/nu13082723.

Stavridou A, Kapsali E, Panagouli E, Thirios A, Polychronis K, Bacopoulou F, Psaltopoulou T, Tsolia M, Sergentanis TN & Tsitsika A (2021). Obesity in children and adolescents during COVID-19 pandemic. *Children* 8(2):1–16. doi:10.3390/children8020135.

Tapsell LC, Neale EP, Satija A & Hu FB (2016). Foods, nutrients, and dietary patterns: interconnections and implications for dietary guidelines. *Adv Nutr* 7(3):445–454. doi:10.3945/an.115.011718.

Ugelta S, Sutresna N, Pitriani P, Fitrianingsih ADR & Zaeri A (2022). The effects of isotonic and isometric training on young women's waist circumference. *Ann Appl Sport Sci* 10(1):1–7.

Yumuk V, Tsigos C, Fried M, Schindler K, Busetto L, Micic D & Toplak H (2015). European guidelines for obesity management in adults. *Obes Facts* 8(6):402–424. doi:10.1159/000442721.

Zachary Z, Brianna F, Brianna L, Garrett P, Jade W, Alyssa D & Mikayla K (2020). Self-quarantine and weight gain related risk factors during the COVID-19 pandemic. *Obes Res Clin Pract* 14(3):210–216. doi:10.1016/j.orcp.2020.05.004.

Zeballos E & Todd JE (2020). The effects of skipping a meal on daily energy intake and diet quality. *Public Health Nutr* 23(18):3346–3355. doi:10.1017/S1368980020000683.