The Increase of Student Obesity Rates During Online Learning in Medical Students

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Abstract. Obesity could increase the risk of cardiovascular diseases, and now it is the first comorbid for COVID-19. It occurs chronically because of the positive energy balance. Body mass index (BMI) is related to the amount of fat. This index can predict how the burden of obesity might affect everyone in the future include cardiovascular disease (CVD). The pandemic has forced students to undergo online learning for more than a year. It may result in higher physical immobility because they do not have to go to campus and all learning activities are carried out in front of their gadgets day by day. We wanted to determine the student obesity rates after a year of online learning. It was conducted in May 2021. There were 100 first-year students at the Faculty of Medicine Universitas Islam Indonesia (FMUIII) were selected in our cross-sectional survey, aged ≥ 18 years old. The structured questionnaire collected information of demographics, height (based on a history of the recent measurement), weight before the pandemic and nowadays, diet and physical activity patterns. Obesity incidence was defined as BMI ≥ 25,0 kg/m2. The student obesity rates skyrocketed to 31% in a year of online learning. The student's body weight increased by 3 (-24–30) kg. Most students (63%) gained weight. It might be related to their excessive energy intake (120 ± 31% based on Indonesian RDA) and low physical activity. We found 55% of students did a light physical activity, and their sedentary times were 9 (4–23) hours per day. Conclusion. The one year of online learning increased obesity rates and the risk of CVD in students.

Keywords: obesity · online learning · covid-19 · cardiovascular risk

1 Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Worldwide obesity has nearly tripled since 1975. In 2016, 39% of adults aged 18 years and over were overweight, and 13% were obese.[1] Obesity is a multifactorial disease with complex pathogenesis related to various factors and heterogeneity in the pathways and mechanisms by which it leads to adverse health outcomes.[2] Obesity is measured in body mass index (BMI), a ratio of body weight (in kilograms) divided by the square of height (in meters). The World Health Organization defines overweight as BMI 25,0–29,9 kg/m2 and obesity as a BMI ≥ 30 kg/m2. The country-specific cut-points

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have been developed for Asian subpopulations such as Indonesia, which cut-points of ≥ 25,0 kg/m2 for obesity.[3].

The trends in obesity prevalence highlight the significant impact that obesity will continue to have on cardiovascular disease (CVD) incidence and prevalence globally. Cardiovascular disease mortality and morbidity is elevated in individuals who are overweight, particularly with central deposition of adipose tissue.[4] Obesity may be associated with hypertension, dyslipidemia, diabetes, or insulin resistance, and elevated levels of fibrinogen and C-reactive protein, all of which increase the risk of CVD events.[5] Obesity has been shown to increase the risk of high blood pressure. Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure, and arterial aneurysm, and is a leading cause of chronic kidney failure. Moderate elevation of arterial blood pressure leads to shortened life expectancy, which also increases the risk of heart diseases.[6][7] The highest rates of obesity are usually found among young adults. In developing countries, obesity prevalence ranges from 2–12% and overweight from 28%, both mostly affecting females.[8] In Indonesia for age > 18 years old, there were 21,8% obese people and 13,6% overweight.[9] Cardiovascular morbidity was raised from 0,5% in 2013[10] to 0,7% in 2018.[9] Young adults between 18–25 years old are in a transition period from adolescence to adulthood. Until nowadays, it was perceived that obesity mostly affected middle-aged adults. However, an increasing trend of obesity among young adults, especially college and university students, is becoming evident. The increased consumption of fast foods, snacking, and skipping breakfast in young adults all escalate the risk of being overweight or obese later in life.[11] The majority of young adults fail to meet international recommendations on exercise, and that the proportion of overweight is increasing in both genders and across all age groups.[12].

For decades, doctors have been trained by observing and learning from experienced clinical practitioners through work-integrated learning.[13] The COVID-19 has resulted in schools shutting across the world. As a result, education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms.[14] Online learning during the pandemic-induced lockdown resulted in more severe effects on nutritional status. The poor nutritional behavior and lack of exercise have resulted in predictable and unhealthy increases in weight gain during the pandemic.[15] The objectives of this study are to determine the prevalence of obese students and its related factors after a year of online learning.

2 Method

2.1 Participants and Procedures

The minimal sample size was calculated at 86 subjects based on the Lemeshow formula. All subjects were recruited via online flyers on social media networks. There were 104 first-year medical students enrolled in our study, four of whom had significant data gaps and were therefore removed from the database. Exclusion criteria included could not finishing all the questionnaires and having a history of eating disorders and or sleep disorders.

This cross-sectional study was performed by following per under the Helsinki Declaration of Human Studies and approved by the Ethical Committee of FMUII

(11/Ka.Kom.Et/70/KE/II/2021) All adults provided prior written informed consent online and were made aware that participation in our study was voluntary and anonymous.

2.2 Measures

2.2.1 Nutritional Status

Body mass index (BMI) was calculated with the formula: weight in kg/ (height in meter)2. Weight and height were based on the history of recent measurements. We knew pre-online learning subjects' weight by digital questionnaire and the recent weight was measured by themselves. We demonstrated a weight measurement video in a zoom meeting before questionnaire distribution and attached its measurement picture in the questionnaire.

2.2.2 Dietary Assessment

Dietary assessment was known by 3x 24 h food record. Two days on weekdays and one day on weekends. For analysis, we used Nutrisurvey and concluded the mean of the three days as a dietary consumption.

2.2.3 Physical Activity

Global physical activity questionnaire (GPAQ) was developed by WHO for physical activity surveillance in countries. It collected information on physical activity participation in three settings (or domains) as well as sedentary behavior, comprising 16 questions. The domains were actively at work, travel to and from places, recreational activities.[16] It was validated with adults, mostly women which were like our subjects.

2.3 Statistical Analysis

As a first step, we entered socio-demographic variables. Then we described the consumption of energy, lipids, protein, and carbohydrates as descriptive data, also for subjects' physical activity level by SPSS.

3 Result and Discussion

3.1 Characteristics of Subjects

Table 1 showed the results of descriptive statistics to the total subjects (n = 100). In March 2020-May 2021, the weight difference of men was 3 (-24 – 30) kg and 2 (-9 – 11) kg for women.

3.2 Transition of Nutritional Status

Most students got a positive transition of nutritional status (Table 2). There were 63% gained weight, 31% lost weight, 6% did not have weight change. The obesity rate skyrocketed to 31% after a year of online learning. If we included the overweight number, it would be 44%. It was meant almost half of the subjects were overweight and obese.

Table 1. Characteristics of subjects

Variables	Men (n = 25%)	Women (n = 75%)
Age (years)	19 (18–21)	
Height (cm)	169 ± 5	158 (150–174)
After a year e-classes	74 ± 17	53 (39–88)
Before e-classes	71 ± 17	52 (37–85)
Weight difference (kg)	3 (-24–30)	2 (-9–11)
After a year e-classes	25,87 ± 5,46	21,07 (15,62–33,95)
Before e-classes	24,81 ± 5,75	20,69 (14,82–33,33)
BMI difference (kg/m^2)	0,91 (-8,50–9,80)	0,73 (-3,56–4,30)

Table 2. The nutritional status transition of subjects

Nutritional status	Before e-classes	After 1y e-classes
BMI (kg/m^2)		
Underweight (<18,5)	18%	18%
Normal (18,5–22,9)	48%	38%
Overweight (23,0–24,9)	14%	13%
Obese I (25,0–29,9)	13%	23%
Obese II (≥30,0)	7%	8%
Weight (kg)	56 (37–115)	59 (39–120)
BMI (kg/m^2)	21,9 ± 4,0	23,6 ± 4,70

3.3 Intakes of Energy and Macronutrients

Based on the newest Indonesian recommended dietary allowances (RDA) 2019. Most of the students' protein intakes were close to double of protein requirement (Table 3).

3.4 Physical Activity

We found that the median of subjects' physical activity was 480 (0–9240) METs per week. It was less than WHO recommendation which was minimum 600 METs per week. The students spent 9 (4–23) hours per day on sedentary activity (Table 4). Our data showed that part of the subject did a very light physical activity and or even no physical activity for a day.

Table 3. Intakes of energy and macronutrients

Variables	Intakes	Proportion of RDA (%)
Energy (kcal/day)	2822 ± 806	120 ± 31
Protein (g/day)	136 (47–450)	190 (77–234)
Lipid (g/day)	109 ± 42	155 (61–324)
Carbohydrates (g/day)	291 (82–776)	81 ± 31
The proportion RDA (%)	Men (n = 25%)	Women (n = 75%)
Energy	127 ± 34	118 ± 31
Protein	193 ± 79	190 (78–234)
Lipid	163 ± 69	159 ± 56
Carbohydrates	85 ± 40	80 ± 27

Table 4. Physical activity of subjects

Physical activity	n (%)
Vigorous activity	
Yes	6
No	94
Moderate activity	
Yes	37
No	63
Trip	
Yes	21
No	79
Recreation as vigorous activity	
Yes	24
No	76
Recreation as moderate activity	
Yes	41
No	59
Median of METs per week	480 (0–9240)
Physical activity level	
Vigorous (≥3000 METs – minutes/week)	14

(*continued*)

Table 4. (*continued*)

Physical activity	n (%)
Moderate (600–2999 METs– minutes/week)	31
Light (< 600 METs – minutes/week)	55
Sedentary time (hours)	9 (4–23)

4 Discussion

We found obese students raised to 31% after a year of online learning. Katsoulis et.al predicted the obesity rates would improve 15% after a year of physical distancing, and it would be higher in young adults.[17] As many as 63% of our subjects gained weight. Inline with our data, there were 61% of young adults experienced weight improvement for one-year pandemic.[18] Chinese students' weight changes were 2,6 (2,0–3,2) kg in men and 2,1 (1,9–2,4) kg in women.[19] Increased weight has consequences for various chronic diseases that need to be detected and addressed early on. Changes in daily activities and physical isolation during online learning were associated with a positive energy balance. Restrictions on mobility and access to public facilities made us more likely to engage in sedentary activities that require very little energy. This restrictions policy also provided opportunities for irregular eating patterns, more often snacking, and lower physical activity.

Weight improvement was associated with increased blood pressure. Weight gain of 3,7 kg in eight weeks increased the amount of visceral fat and systolic blood pressure (SBP).[20] In the population, an increase of 2 mmHg of SBP was associated with a 7% improved risk of ischemic heart disease and 10% improved risk of stroke.[21] Although the pathophysiology of the association between obesity and hypertension was multifactorial, it appeared that visceral fat tissue was the key to these mechanisms.[22] Visceral fat tissue was an intermediary between obesity and the sympathetic nervous system.[23] Sympathetic activity in the muscles and heart of abdominal obesity subjects was higher than in subcutaneous obesity subjects.[24] Besides, the renin-angiotensin system (RAS) was more abundant in the visceral compartment [25] so that the expansion of visceral fat would increase the production of angiotensinogen and angiotensin II which would eventually increase blood pressure.

Nutritional status was influenced by energy intake and physical activity. Pandemic and physical isolation significantly reduce physical activity. Our data did not compare the subject's physical activity before and after e-classes but showed that part of the subjects did a light physical activity. A study in Brazil stated that 60% of subjects only did light activities during physical isolation. It increased rapidly, which was only 31% before the pandemic.[26] Italian students also showed similar results with our data, which was 51% of students did a light physical activity. And only 12% of subjects stated that they were doing the same level of physical activity as before the pandemic.[27] Based on the recommendations of WHO and the Indonesian Ministry of Health, we were recommended to do a moderate physical activity at least 30 min per day for 5x per week, or 75 min of vigorous activity per week, or a combination of both. The duration

of this physical activity was equivalent to a minimum of 600 METs per week. Moderate physical activity was defined as if we did it, our body sweated a little, heart rate and respiratory rate became faster, but still comforted for talking. Examples of this type of activity were brisk walking (5 km/hour) on a flat surface indoor or outdoor and leisurely walking during work breaks; moving light tools, gardening, planting trees, washing cars; carrying and stacking logs, cutting the grass with a lawnmower; and sports such as recreational badminton, dancing, table tennis, bowling, non-competitive volleyball, skateboarding, etc. All these types of activities require 3,5–7 kcal/minute.[28] Part of our subjects sometimes did physical activities such as jogging and cycling around their home. Although we did not examine their domicile further, it appeared that residential location was related to the level of physical activity. Kunstler et al. said that subjects in rural areas did physical activity more often than subjects in urban areas, it was also for subjects' METs rate.[29].

5 Conclusion

Our obese students increased to 31% after a year of online learning. Students consumed sufficient carbohydrates but excess energy, protein, and lipids. We should emphasize students maintain an active life during e-classes and it is beneficial for their long-term healthiness.

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