

## CHANGES IN DIET AND PHYSICAL ACTIVITY IN STUDENTS DURING LOCKDOWN BY EXAMPLE OF COVID-19 PANDEMIC

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### ABSTRACT

**Background.** Due to the spread of COVID-19 infections around the world, in early 2020, the World Health Organization (WHO) announced a global pandemic, i.e. an epidemic of particularly large dimensions affecting countries and entire continents. Long-term stay at home and self-isolation may have significantly impacted lifestyle, diet, food choices and access to food, as well as physical activity in the entire population, including students.

**Objective.** The aim of the study was to examine the impact of social isolation caused by the coronavirus pandemic on changes in diet, lifestyle and body mass index in a group of students, so that we would be better prepared for future new viral infections with characteristics similar to Covid-19.

**Material and Methods.** The study was conducted in 2021 using a cross-sectional online survey (using the CAWI technique). The survey was addressed to students of universities in Poland who were over 18 years of age. After excluding forms completed incorrectly or with incorrect data, the final analysis of the results included the responses of 196 respondents. Statistical analyzes were performed in STATISTICA 13.3. Statistical significance was assumed at the level of  $p \leq 0.05$ .

**Results.** The study involved 136 women and 60 men with an average age of 23. The majority of respondents were residents of cities with over 500,000 inhabitants (50%), were students of 1st degree (45%) in medical/natural sciences (36%). The largest percentage of respondents (above 70%), before the pandemic and during isolation, had normal body weight, according to the BMI. There were significant statistical differences between gender and changes during COVID-19 pandemic in sleeping ( $p=0.013$ ), physical activity ( $p=0.028$ ), as well as the consumption of tea ( $p=0.047$ ), milk and dairy products ( $p=0.041$ ), alcohol ( $p=0.001$ ) and red meat ( $p=0.003$ ), vegetables ( $p=0.049$ ), sweets ( $p=0.029$ ) and fast food ( $p=0.004$ ).

**Conclusions.** Due to the fact that the impact of the coronavirus pandemic on the diet and lifestyle has been demonstrated, it is very important that the recommendations of public health organizations spread the message about rational nutrition and physical activity in the event of new viral infections among young people, including students.

**Key words:** COVID-19 pandemic, social isolation, changes in diet, beverages, food products, lifestyle, students

### INTRODUCTION

As the result of the spread of a new disease called coronavirus (COVID-19), at the beginning of 2020, the World Health Organization declared a global pandemic. Due to the declaration of a global pandemic, on March 20, 2020, the Polish government officially announced the state of epidemic in the country, and then on March 25 it ordered the introduction of the obligation to social distance, stay at home for self-isolation, remote work and further closure of kindergartens, schools and universities [7, 13, 16]. Public health recommendations and government restrictions have led to a radical change in everyday life, including social distancing and isolation at home. Prolonged stay at home and self-isolation can significantly impact lifestyle, diet, food

choices and access to food, as well as physical activity in the entire population, including students [13]. It was the first situation of this kind in the world, the effects of which can be used as models in scientific research, also in the field of human nutrition. Scientific publications define the pandemic as a sudden phenomenon characterized by the multidimensionality of medical and socio-economic experience, the effects of which are currently visible and the repercussions will be felt in the future [6].

According to the definition of the World Health Organization, coronavirus (COVID-19) is a disease caused by infection with the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2). Most people infected with this virus experience mild or moderate respiratory symptoms and become infected

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without specific treatment. However, in some cases, the infection causes serious symptoms and requires special treatment and hospitalization. Older people, as well as people suffering from diseases such as circulatory system diseases, diabetes, chronic respiratory diseases or cancer, are more vulnerable to a serious course of the disease. Anyone can get sick with COVID-19 and experience serious symptoms or die, regardless of age [26].

The virus spreads through droplets from an infected person's mouth or nose, in small particles of liquid when they cough, sneeze, talk, sing or breathe. Transmission takes place mainly through larger droplets and respiratory aerosols [19]. How the virus infection progresses varies greatly depending on the patient's individual characteristics and the dose of the virus to which the patient was exposed [4]. Symptoms of COVID-19 infection appear on average 5-6 days after exposure to the virus, and the infection usually lasts up to 14 days [25].

Physiological states of the body and comorbidities potentially related to poor health, such as old age, obesity, diabetes or hypertension, have been identified as risk factors for severe and fatal courses of the disease. It has been found that people with diseases associated with organ damage, mainly the heart, liver and kidneys, are even more at risk of fatal virus infection [23]. In Spanish study carried out a retrospective cohort in patients between 18 and 70 years of age, included students diagnosed with COVID-19 and hospitalized. As a main result, it was observed that patients with a sedentary lifestyle had an increase in mortality from COVID-19 regardless of other previous risk factors. The authors concluded that a sedentary lifestyle increases the mortality of patients hospitalized with COVID-19 [18].

Safety measures and restrictions on movement, combined with the need for isolation and social distancing, are important in reducing the number of infections. However, restrictions may negatively impact people's mental health and lifestyle, including their diet, behavior and physical activity [1]. Students are among the group of people who are at risk of adverse reactions as a result of the restrictions introduced. Research indicates that students show high levels of stress and depression associated with isolation [21, 27]. In addition, fear of contracting COVID-19 and social isolation and reduced physical activity may lead to the consumption of excessive amounts of energy through food, which results in weight gain and eating disorders [2, 20, 22].

The impact of the COVID-19 pandemic on social functioning is very broad and complex. No aspect of normal social functioning was spared. Quarantine and social distancing are necessary measures to prevent the spread of the virus, but they can lead to repercussions

related to both physical and mental health [15]. They can radically change individuals' daily habits, including related behaviors with lifestyle. Long-term stay and work at home may affect diet, food choice and access to food, and at the same time significantly limit physical activity [13]. Therefore, the aim of the study was to examine the impact of social isolation caused by the coronavirus pandemic on changes in diet and physical activity in a group of students, which could be a reflection and basis for information for future pandemics based on the lessons learned from COVID-19.

## MATERIAL AND METHODS

### *Sample*

The survey was conducted from November to December 2021, after several periods of COVID-19 quarantine in Poland and self-isolation, learning and remote work, as well as difficult access to internal and external exercise areas. The survey was addressed to students of universities in Poland who were over 18 years of age. The questionnaire was completed by 206 people. After excluding incorrectly completed forms or with incorrect data, the responses of 196 respondents were included in the final analysis of the results.

### *Data collection*

The original questionnaire was used, which was administered as a Google form distributed in social media and included questions on socio-demographic and anthropometric data, questions regarding changes in diet and physical activity during social isolation caused by the pandemic. Questions about socio-demographic data concerned, among others, information related to gender (female or male), age, place of residence (village; town up to 500,000 inhabitants or city over 500,000 inhabitants), as well as the degree of study (1<sup>st</sup> degree - engineering/bachelor's degree; 2<sup>nd</sup> degree - master's degree; long-cycle degree - master's degree or 3<sup>rd</sup> degree - doctoral school), mode (full-time; part-time or evening) and field of study (artistic; economic/administrative; humanities/philological; medical/natural sciences; socio-pedagogical; technical or tourist/sports). The anthropometric data collected was height and body weight declared by respondents (before the pandemic and during the study). The collected anthropometric data, body mass (kg) and height (m) of the respondents, were used to calculate the Body Mass Index (BMI). The formula  $BMI = \text{body weight}/(\text{height})^2$  ( $\text{kg}/\text{m}^2$ ) was used for the calculations four ranges of values were adopted:  $<18.5$  ( $\text{kg}/\text{m}^2$ ) - underweight, 18.5-24.9 ( $\text{kg}/\text{m}^2$ ) - normal body weight, 25.0-29.9 ( $\text{kg}/\text{m}^2$ ) - overweight and  $>30.0$  ( $\text{kg}/\text{m}^2$ ) - obesity [24]. Questions about changing diet (no consumption; less consumption; no changes or more consumption) concerned the amount of meals prepared at home before the pandemic and during

isolation, problems with access to food (yes or no) and the consumption of selected groups of food, such as: vegetables, fruits, legumes, whole grain products, eggs, white meat (e.g. poultry), red meat (e.g. beef), processed meat products, fish and seafood, fast food, sweets and sweet snacks, homemade sweets, salty snacks, as well as selected beverages eg.: milk and milk products, fermented milk products, water, fruit juices, sweetened drinks, coffee, tea, energy drinks and alcohol. The next stage of the survey included questions about the level of physical activity before the pandemic and its change during isolation, as well as changes in time spent in front of screens of electronic devices (for purposes other than studying or work) and changes in time spent on sleep (decreased; no changes or increased) [5, 13, 17].

#### Statistical analyses

The percentages of respondents were calculated, and the Pearson  $\chi^2$  test was used for the statistical analysis. Statistical analysis of the results was performed using Statistica 13.3 software (TIBCO Software Inc., Palo Alto, California, USA). Statistical significance was assumed at  $p \leq 0.05$ .

## RESULTS

In the study took part 135 female and 60 male. The average age of the surveyed people was 23 years. Half of the respondents taking part in the study were people living in large cities with over 500,000 inhabitants. The other half of the surveyed group consisted of people living in towns up to 500,000 inhabitants (31%) or village (19%). In the study, the largest group, consisting of 45% of respondents were students of 1<sup>st</sup> degree, then students of 2<sup>nd</sup> degree (34%). The smallest percentage of respondents were students of 3<sup>rd</sup> degree (4%). Most respondents were full-time students (70%). Part-time students accounted for 29%, and evening students - 1%. The largest group of respondents were students of medical/natural sciences (36%). Students of economic and administrative faculties constituted 20% of the respondents, socio-pedagogical students 16%, technical studies 12%, and humanities/philosophical studies 10%. The smallest group were respondents declaring an artistic field (3%) or tourism/sports field (3%).

Table 1 shows changes in BMI and selected lifestyle factors during the COVID-19 pandemic. The majority

Table 1. Changes in BMI and lifestyle during COVID-19 pandemic in students (n=196)

| Variables  | Female<br>69.4% (n=136) | Male<br>30.6% (n=60) | p-value |
|--|-------------------------|----------------------|---------|
| BMI before pandemic:                                 |                         |                      |         |
| underweight  | 11.8 (16)               | 5.0 (3)              | 0.347   |
| normal weight  | 73.5 (100)              | 80.0 (48)            |         |
| overweight   | 12.5 (17)               | 10.0 (6)             |         |
| obesity  | 2.2 (3)                 | 5.0 (3)              |         |
| BMI during pandemic:                                 |                         |                      |         |
| underweight  | 10.3 (14)               | (0)                  | 0.274   |
| normal weight  | 75.0 (102)              | 81.7 (49)            |         |
| overweight   | 14.0 (19)               | 15.0 (9)             |         |
| obesity  | 0.7 (1)                 | 3.3 (2)              |         |
| Sleep time changes:                                  |                         |                      |         |
| decreased  | 16.9 (41)               | 15.0 (9)             | 0.013   |
| no changes   | 30.2 (23)               | 51.7 (31)            |         |
| increased  | 52.9 (72)               | 33.3 (20)            |         |
| Screen time changes:                                 |                         |                      |         |
| decreased  | 2.9 (4)                 | 1.7 (1)              | 0.608   |
| no changes   | 19.9 (27)               | 15.0 (9)             |         |
| increased  | 77.2 (105)              | 83.3 (50)            |         |
| Physical activity changes:                           |                         |                      |         |
| decreased  | 47.1 (64)               | 58.3 (35)            | 0.028   |
| no changes   | 25.7 (35)               | 31.7 (19)            |         |
| increased  | 27.2 (37)               | 10.0 (6)             |         |
| Difficulties with food availability during pandemic: |                         |                      |         |
| no   | 90.4 (123)              | 90.0 (54)            | 0.543   |
| yes  | 9.6 (13)                | 10.0 (6)             |         |
| Changes in total food consumption during pandemic:   |                         |                      |         |
| less consumption                                     | 9.5 (13)                | 13.4 (8)             | 0.180   |
| no changes   | 30.9 (42)               | 33.3 (20)            |         |
| more consumption                                     | 59.6 (81)               | 53.3 (32)            |         |

of people participating in the study, both before and during the pandemic, had a normal BMI. During the pandemic, a decrease in the percentage of respondents who are underweight and obese was observed compared to before the pandemic. During the pandemic, the percentage of students whose BMI indicated overweight, increased. No statistically significant differences were found between the BMI value and

the gender of the examined persons. The largest percentage of the examined students declared increased sleep time, increased screen time and increased total food intake during the pandemic, compared to time before. The largest percentage of respondents declared reduced physical activity and no difficulties with food availability during the pandemic. In the study group, a statistically significant difference was found between

Table 2. Changes in beverages consumption during COVID-19 pandemic in students (n=196)

| Variables                         | Female<br>69.4% (n=136) | Male<br>30.6% (n=60) | p-value |
|-----------------------------------|-------------------------|----------------------|---------|
| Tea intake:                       |                         |                      |         |
| non consumption                   | 2.2 (3)                 | 1.7 (1)              | 0.047   |
| less consumption                  | 19.1 (26)               | 21.7 (13)            |         |
| no changes                        | 39.0 (53)               | 56.7 (34)            |         |
| more consumption                  | 39.7 (54)               | 19.9 (12)            |         |
| Coffe intake:                     |                         |                      |         |
| non consumption                   | 11.8 (16)               | 21.7 (13)            | 0.105   |
| less consumption                  | 27.2 (37)               | 35.0 (21)            |         |
| no changes                        | 38.2 (52)               | 25.0 (15)            |         |
| more consumption                  | 22.8 (31)               | 18.3 (11)            |         |
| Water intake:                     |                         |                      |         |
| non consumption                   | 0.7 (1)                 | (0)                  | 0.159   |
| less consumption                  | 18.4 (25)               | 6.7 (4)              |         |
| no changes                        | 39.7 (54)               | 43.3 (26)            |         |
| more consumption                  | 41.2 (56)               | 50.0 (30)            |         |
| Milk and milk products intake:    |                         |                      |         |
| non consumption                   | 6.0 (8)                 | 3.4 (2)              | 0.041   |
| less consumption                  | 15.4 (21)               | 15.0 (9)             |         |
| no changes                        | 52.9 (72)               | 69.9 (42)            |         |
| more consumption                  | 25.7 (35)               | 11.7 (7)             |         |
| Fermented milk drinks intake:     |                         |                      |         |
| non consumption                   | 14.7 (20)               | 15.0 (9)             | 0.124   |
| less consumption                  | 11.8 (16)               | 3.4 (2)              |         |
| no changes                        | 53.8 (73)               | 68.3 (41)            |         |
| more consumption                  | 19.7 (27)               | 13.3 (8)             |         |
| Sugar-sweetened beverages intake: |                         |                      |         |
| non consumption                   | 24.3 (33)               | 11.7 (7)             | 0.229   |
| less consumption                  | 22.8 (31)               | 23.3 (14)            |         |
| no changes                        | 35.3 (48)               | 43.3 (26)            |         |
| more consumption                  | 17.6 (24)               | 21.7 (13)            |         |
| Fruit juices intake:              |                         |                      |         |
| non consumption                   | 8.9 (12)                | 6.7 (4)              | 0.359   |
| less consumption                  | 19.1 (26)               | 28.3 (17)            |         |
| no changes                        | 52.9 (7)                | 53.3 (32)            |         |
| more consumption                  | 19.1 (26)               | 11.7 (7)             |         |
| Energy drink intake:              |                         |                      |         |
| non consumption                   | 44.1 (60)               | 33.3 (20)            | 0.286   |
| less consumption                  | 19.7 (27)               | 28.3 (17)            |         |
| no changes                        | 26.5 (36)               | 23.3 (14)            |         |
| more consumption                  | 9.7 (13)                | 15.1 (9)             |         |
| Alcohol consumption:              |                         |                      |         |
| non consumption                   | 16.2 (22)               | 11.7 (7)             | 0.001   |
| less consumption                  | 28.8 (39)               | 58.3 (35)            |         |
| no changes                        | 35.3 (48)               | 18.3 (11)            |         |
| more consumption                  | 19.7 (27)               | 1.7 (7)              |         |

the gender in the change in the sleep time and physical activity during the pandemic. Women slept longer ( $p=0.013$ ) and showed less physical activity ( $p=0.028$ ) compared to men.

The study showed changes in the consumption of selected beverages that occurred during the COVID-19 pandemic (Table 2). It was found that at that time the largest percentage of people declared higher water consumption and lower alcohol consumption, while the consumption of other drinks remained unchanged. Statistically significant differences were found between gender and the change in consumption of tea ( $p=0.047$ ), milk and dairy products ( $p=0.041$ ) and alcohol ( $p=0.001$ ). It was found that during the pandemic, a larger percentage of men compared to women consumed less alcohol and more of them kept

their consumption of tea, milk and dairy products unchanged.

Table 3 shows changes in the consumption of selected food products that occurred during the COVID-19 pandemic. It was found that the largest percentage of people at that time declared a higher consumption of homemade sweets and a lower consumption of fast food, while the consumption of other products remained unchanged. Statistically significant differences were found between gender and the change in consumption of red meat ( $p=0.003$ ), vegetables ( $p=0.049$ ), sweets and sweet snacks ( $p=0.029$ ) and fast food ( $p=0.004$ ). It was found that during the pandemic, a greater percentage of men compared to women consumed more vegetables, less fast food, and more of them kept their consumption of red meat, sweets and sweet snacks unchanged.

Table 3. Changes in food consumption during COVID-19 pandemic in students ( $n=196$ )

| Variables                    | Female<br>69.4% (n=136) | Male<br>30.6%(n=60) | p-value |
|------------------------------|-------------------------|---------------------|---------|
| Whole grain products intake: |                         |                     |         |
| non consumption              | 4.4 (6)                 | 5.1 (3)             | 0.951   |
| less consumption             | 14.7 (20)               | 11.7 (7)            |         |
| no changes                   | 61.0 (83)               | 63.3 (38)           |         |
| more consumption             | 19.9 (27)               | 19.9 (12)           |         |
| Eggs intake:                 |                         |                     |         |
| non consumption              | 4.4 (6)                 | 5.1 (3)             | 0.539   |
| less consumption             | 14.0 (19)               | 18.3 (11)           |         |
| no changes                   | 55.9 (76)               | 60.0 (36)           |         |
| more consumption             | 25.7 (35)               | 16.6 (10)           |         |
| Fishes and seafood intake:   |                         |                     |         |
| non consumption              | 16.1 (22)               | 13.4 (8)            | 0.777   |
| less consumption             | 18.4 (25)               | 18.3 (11)           |         |
| no changes                   | 51.5 (70)               | 58.3 (35)           |         |
| more consumption             | 14.0 (19)               | 10.0 (6)            |         |
| Processed meat intake:       |                         |                     |         |
| non consumption              | 21.3 (29)               | 8.3 (5)             | 0.168   |
| less consumption             | 16.9 (23)               | 20.0 (12)           |         |
| no changes                   | 50.0 (68)               | 60.0 (36)           |         |
| more consumption             | 11.8 (16)               | 11.7 (7)            |         |
| Red meat intake:             |                         |                     |         |
| non consumption              | 29.4 (40)               | 10.0 (6)            | 0.003   |
| less consumption             | 21.3 (29)               | 13.4 (8)            |         |
| no changes                   | 41.9 (57)               | 61.5 (37)           |         |
| more consumption             | 7.4 (10)                | 15.1 (9)            |         |
| Wheat meat intake:           |                         |                     |         |
| non consumption              | 16.1 (22)               | 6.7 (4)             | 0.138   |
| less consumption             | 14.9 (20)               | 11.7 (7)            |         |
| no changes                   | 52.9 (72)               | 55.0 (33)           |         |
| more consumption             | 16.1 (22)               | 26.6 (16)           |         |
| Vegetables intake:           |                         |                     |         |
| non consumption              | 0.7 (1)                 | (0)                 | 0.048   |
| less consumption             | 19.9 (27)               | 15.1 (9)            |         |
| no changes                   | 50.0 (68)               | 36.7 (22)           |         |
| more consumption             | 29.4 (40)               | 48.2 (29)           |         |

|                          |           |           |       |
|--------------------------|-----------|-----------|-------|
| Fruits intake:           |           |           |       |
| non consumption          | 0.7 (1)   | (0)       | 0.509 |
| less consumption         | 16.1 (22) | 10.0 (6)  |       |
| no changes               | 52.3 (71) | 61.5 (37) |       |
| more consumption         | 30.9 (42) | 28.5 (17) |       |
| Legumes intake:          |           |           |       |
| non consumption          | 5.9 (8)   | 11.7 (7)  | 0.059 |
| less consumption         | 21.3 (29) | 6.7 (4)   |       |
| no changes               | 61.8 (84) | 66.5 (40) |       |
| more consumption         | 11.0 (15) | 9 (15.1)  |       |
| Homemade sweets intake:  |           |           |       |
| non consumption          | 8.0 (11)  | 5.0 (3)   | 0.828 |
| less consumption         | 19.1 (26) | 18.3 (11) |       |
| no changes               | 30.2 (41) | 35.0 (21) |       |
| more consumption         | 42.7 (58) | 41.7 (25) |       |
| Salty snacks:            |           |           |       |
| non consumption          | 5.2 (7)   | 1.6 (1)   | 0.132 |
| less consumption         | 23.5 (32) | 21.7 (13) |       |
| no changes               | 35.3 (48) | 51.7 (31) |       |
| more consumption         | 36.0 (49) | 25.0 (15) |       |
| Sweets and sweet snacks: |           |           |       |
| non consumption          | 2.9 (4)   | (0)       | 0.029 |
| less consumption         | 25.0 (34) | 28.3 (17) |       |
| no changes               | 29.4 (40) | 46.7 (28) |       |
| more consumption         | 42.7 (58) | 25.0 (15) |       |
| Fast food intake:        |           |           |       |
| non consumption          | 14.7 (20) | 3.4 (2)   | 0.004 |
| less consumption         | 33.1 (45) | 58.3 (35) |       |
| no changes               | 28.7 (39) | 25.0 (15) |       |
| more consumption         | 23.5 (32) | 13.3 (8)  |       |

## DISCUSSION

In this study, it was shown that the largest percentage of respondents, before the pandemic and during isolation, had normal body weight, according to the BMI index. We observed the largest percentage of the examined students declared increased sleep time, increased screen time and increased total food intake during the pandemic compared to time before. It was found that significantly more women admitted an increase in sleep and a decrease in physical activity, compared to men. We observed the largest percentage of participants declared more consumption: water and homemade sweets and less consumption: alcohol and fast food during pandemic. The significant statistical differences between gender and changes during COVID-19 pandemic in the consumption of tea, milk and dairy products, alcohol and red meat, vegetables, sweets and sweet snacks and fast food were observed.

In our study, we found that the largest percentage of respondents before the pandemic and during isolation had normal body weight and decreased physical activity. Research shows similar results regarding the decline in physical activity, but different results for body weight [8, 9, 12]. In study Giustino et al. [12] analyzed the

change in the level of physical activity based on energy expenditure (min/week) among the physically active population of Sicily before and during the last seven days of quarantine. The relationship between this parameter and specific demographic and anthropometric variables was also analyzed. It was found that quarantine had a negative impact on the level of physical activity, with the greatest effect among men and overweight people. With respect to age groups, adolescents, young adults, and adults were more affected than older adults and seniors. In the study Dobrowolski and Włodarek [8] was described the impact of social isolation in the first phase of the pandemic on body weight, physical activity and eating behavior of Poles. Almost 50% of the surveyed people observed an increase in body weight due to a decrease in physical activity and an increase in food consumption. For people whose overall weight did not decrease or change, the increase was approximately 2 kg during the short period of pandemic restrictions. There was a general decrease in the level of physical activity among the respondents, as well as changes in the amount of food consumed and individual groups of food products, including alcohol. Another study conducted in a group of Polish women focusing on the impact of the pandemic and social isolation on

body weight changes showed that the isolation period caused bidirectional changes in body weight in the above-mentioned group. More than half of the study participants experienced a change in body weight, 34% of women gained weight, while 18% lost weight. In the weight gain group, women increased their body weight by an average of 2.8 kg, and about 65% of them increased their total food intake. As a negative effect of the pandemic, the percentage of women who were underweight before the pandemic whose body weight decreased and women who were obese before the pandemic who gained weight during social isolation should be assessed [9].

We observed the largest percentage of the examined students declared increased sleep time and increased screen time. Similar results were obtained by Wlazło et al. [22]. The surveyed students from Poland and Turkey also declared an increase in sleep time and time spent in front of TV or computer. However, in the study by Górnicka et al. [13], a similar result was obtained regarding the highest percentage of people who declared an increase in the time spent in front of a computer or TV during the pandemic, while sleep duration remained unchanged in a larger percentage of people at this time.

We found the largest percentage of the examined students declared increased total food intake during the pandemic compared to time before. Similar results were obtained in studies by other authors. The sanitary and epidemiological situation caused by the global spread of SARS-CoV-2 had directly influenced consumer behavior in areas such as gastronomy, grocery shopping and the precautionary measures taken. Panic related to the possibility of COVID-19 infection played a significant role and largely forced customers to change the typical way of shopping for groceries and using the services of catering establishments [14]. For comparison, the main findings in the study Gallo et al. [11] in the early phase of the pandemic, during isolation and a break in attendance for full-time academic classes, there was an increase in total energy consumption, frequency of eating and energy density of consumed food in the group of women, as well as a decrease in the level of physical activity both among women and men. Also in study Ammar et al. [2] reported that students' consumption patterns changed towards more frequent binge eating and uncontrolled eating during lockdown. During the pandemic among a significant number of respondents, there was an increase in the frequency of eating meals prepared at home and eaten among household members. The respondents derived greater joy from cooking and experimenting with recipes. They also reported reducing the frequency of using ready-made meals [10]. However, there were also those who declared that one of the reasons for ordering food from restaurants is the lack of time to prepare it at home and the general lack of desire to prepare dishes

[14]. Interesting results were obtained in Rodriguez-Perez et al. [17] study, which was also conducted in the early phase of the pandemic in 2020 among the adult population. This report was the first to indicate the direction of changes in the diet of Spaniards for the better during social isolation caused by restrictions and social distancing. Respondents showed increased interest in the dietary patterns of the Mediterranean diet. This diet is considered a model of proper and healthy nutrition, it is dominated by vegetables, fruits and olive oil, and is also recommended as one of the ways to strengthen and maintain the proper functioning of the immune system.

In our study we found that largest percentage of participants declared more consumption water and homemade sweets and less consumption alcohol and fast food during pandemic. The significant statistical differences between gender and changes during COVID-19 pandemic in the consumption some of food products were observed. Other studies have observed various changes in the amount of food consumed [3, 10, 13, 22]. In September 2020, *EIT Food* (part of the European Innovation Institute and Technology) [10] conducted a survey among 5,000 consumers in ten European countries, including Poland. It was found there has been a significant increase in the frequency of online and wholesale purchases, as well as an increase in the consumption of almost every food group, especially fruit, vegetables and flour. On the other hand the Canadian study on the impact of the COVID-19 pandemic on college students' food intake, physical activity and lifestyle found that their diet during lockdown was worse than their usual pre-pandemic diet. Reduced frequency of consumption of cereals, fruits, vegetables, dairy products, nuts, meat and its plant alternatives was observed. Reducing the consumption of these products has contributed to an insufficient supply of both macro- and micronutrients and an increase in the occurrence of nutritional deficiencies [3]. Changes in the frequency of consumption of vegetables, fruit, legumes, milk and fish before and during the pandemic were also found among Polish and Turkish students [22]. Whereas, in the study Górnicka et al. [13], the largest percentage of respondents did not declare any changes in the consumption of main groups of selected food products during the pandemic.

It seems that in the event of the above threat among students, it would be helpful to create the position of a coordinator for counteracting viral infections at universities, as well as an appropriate website. The above would provide information on the correct way to deal with an emergency situation by including dietary recommendations that are aimed at supporting the immune system, and would also encourage physical activity.

### *Strengths and limitations*

The present study had some limitations. First, our sample size was not large and we cannot generalize our results. Second, our data was based on self-assessment selected anthropometric measurements and change in food consumption. There is a lack of quantitative data on food consumption. Third, our study only examined the short-term impacts of the pandemic on food consumption, lifestyle and body weight.

The strengths of the study was used an online survey because epidemic situation makes it impossible to conduct research in stationary conditions. Moreover, our study allowed us collected data about lifestyle, selected anthropometric measurements and food consumption before and during COVID-19 pandemic.

## CONCLUSION

1. It was shown that the largest percentage of respondents, before the pandemic and during isolation, had normal body weight, according to the BMI index.
2. The largest percentage of the examined students declared increased sleep time, screen time and total food intake during the pandemic compared to the time before. It was found that significantly more women admitted an increase in sleep and a decrease in physical activity, compared to men.
3. We found the largest percentage of participants declared more consumption: water and homemade sweets and less consumption: alcohol and fast food during pandemic. The significant statistical differences between gender and changes during COVID-19 pandemic in the consumption of tea, milk and dairy products, alcohol and red meat, vegetables, sweets and sweet snacks and fast food were observed.
4. In the event of the appearance of new viral infections and the need to introduce isolation in social life, it is very important to educate the public by public health organizations by providing dietary recommendations and maintaining physical activity among young adults.

### **Conflict of interest**

*The authors declare that there are no conflict of interest regarding the publication of this paper.*

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