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# Youth relationships during the pandemic Covid-19 matter. A mediating role of social resources on e-learning burnout, well-being, and overeating behaviors

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## Abstract

**Aim:** Youth who are engaging themselves in overeating behaviours are at risk of numerous adverse outcomes. Overeating may be also considered as an early warning sign of additional psychological issues, e.g. poor well-being, depression and suicide ideation. Although a vast body of literature has examined pandemic Covid-19 related stressors as potential risk factors for eating problems, no studies have explored e-learning stress and burnout as a characteristic that may contribute to overeating among adolescents during this global crisis. The main goal of this study was to test the mediation effect of social resources on the associations between e-school stress and burnout, adolescents' psychological well-being and overeating.

**Method:** Path analysis was conducted on the results of the E-Learning Burnout Scale, the Psychological Well-Being Scale, the Short Social Resource scale, and one-item scales for Overeating behaviours and Online School Stress. Cross-sectional data were collected via Google forms from 186 students (M=15.93 years; SD=1.70; 60% girls).

**Results:** Social resources and e-learning burnout had a significant direct effect on overeating behaviours frequency. The significant indirect effect of psychological well-being via social resources on overeating behaviours was confirmed, however the indirect effect of e-learning burnout was insignificant. Student stress had a significant indirect effect on overeating behaviours via e-learning burnout, and via social resources.

**Conclusions:** E-learning stress and burnout during the Covid-19 pandemic are directly related to the reduction of the individuals' resources used to effectively cope with negative emotions and distress in everyday life, which, in turn, may heighten the risk of engaging in overeating behaviours.

*Keywords:* overeating behaviours, online student burnout, social resources, adolescence

## Streszczenie

**Wstęp:** Młodzież, która angażuje się w zachowania związane z przejadaniem się, jest narażona na wiele niekorzystnych skutków. Przejadanie się może być również uważane za wczesny sygnał ostrzegawczy dodatkowych problemów psychologicznych, np. złego samopoczucia, depresji i myśli samobójczych. Chociaż w obszernej literaturze badano stresory związane z pandemią Covid-19 jako potencjalne czynniki ryzyka problemów z odżywianiem, żadne badania nie analizowały stresu związanego z e-learningiem i wypalenia zawodowego jako cech, które mogą przyczyniać się do przejadania się wśród nastolatków podczas tego globalnego kryzysu. Głównym celem tego badania było sprawdzenie wpływu zasobów społecznych na związek między stresem i wypaleniem związanym z e-szkolą, dobrostanem psychicznym nastolatków i przejadaniem się.

**Materiał i metoda:** Analiza ścieżek została przeprowadzona na wynikach Skali Wypalenia E-Learningowego, Skali Dobrostanu Psychologicznego, Krótkiej Skali Zasobów Społecznych oraz jednopunktowych skal dla zachowań związanych z objadaniem się i Stresu Szkolnego Online. Dane przekrojowe zostały zebrane za pomocą formularzy Google od 186 uczniów (M=15,93 lat; SD=1,70; 60% dziewcząt).

**Dyskusja:** Zasoby społeczne i wypalenie e-learningowe miały istotny bezpośredni wpływ na częstotliwość przejadania się. Potwierdzono istotny pośredni wpływ dobrostanu psychicznego poprzez zasoby społeczne na zachowania związane z objadaniem się, jednak pośredni wpływ wypalenia e-learningowego był nieistotny.

**Wnioski:** Stres studencki miał znaczący pośredni wpływ na zachowania związane z objadaniem się poprzez wypalenie e-learningowe i zasoby społeczne. Stres związany z e-learningiem i wypalenie podczas pandemii Covid-19 są bezpośrednio związane ze zmniejszeniem zasobów jednostek wykorzystywanych do skutecznego radzenia sobie z negatywnymi emocjami i stresem w życiu codziennym, co z kolei może zwiększać ryzyko angażowania się w zachowania związane z objadaniem się.

*Słowa kluczowe:* dorastanie, zachowania związane z objadaniem się, wypalenie studentów online, zasoby społeczne

## Introduction

The period of the Covid-19 pandemic was very difficult for many people, but for the young, who lost elementary needs such as group and self-autonomy overnight, it may have been the most difficult. A pandemic situation is often described by adolescents as one in which they have yet to experience adult support [1, 2], and in the absence of the ability to properly use Internet functions, such a lack can lead to self-aggressive behaviour i.e. intentional suffering, impulsive behaviour (compulsive eating), addiction or neglect of one's own health [3].

Feelings of exclusion or isolation can also influence the occurrence of eating disorders in an individual. According to a study by Griffiths et al. [4], the higher the stigma of eating disorders, the greater the severity of alienation and social withdrawal behaviours. Moreover, social withdrawal was associated with an increase in eating disorder symptoms, which can be seen as a vicious cycle of symptoms. In addition, Santos et al. [5] pointed out that emotional overeating often occurs as a response to worry, boredom or irritation. Already, a study by Puder and Munsch [6] suggested that overeating can be viewed as an individual's coping strategies in an environment where he or she experiences a high amount of stress. In addition, during the pandemic, anxiety partially influenced the relationship between coronavirus stress and an individual's responses such as overeating [7]. The pandemic exacerbated the indirect pathway between stress and overeating through the individual's feelings of anxiety.

The school burnout that students experience reduces their sense of efficacy and achievement, and, in the long term, affects mental and physical health [8, 9,10]. During distance learning, students were significantly more likely to complain of loneliness and mental strain. As a result, they reduced their interest in learning and their motivation to make plans related to future learning. Students, who experienced frustration with e-learning, may engage in negative behaviour and withdrawal from class participation [11]. When students experience a lack of support, their perception of the demands of their studies increases, which, in turn, has a negative impact

on both academic performance and overall mental health [12].

While past theoretical and empirical literature has displayed an association between individuals' mental condition (i.e. distress, depression, burnout and life satisfaction) and health-risk behaviours (i.e. substance abuse, suicide ideation, technological addictions and poor physical activity), the mechanisms underlying this link have received little empirical attention. In particular, the analysis of the relationship between the individual's resources, burnout, and health-threatening behaviours, i.e. overeating, is scarce. Furthermore, to our knowledge, none of the past studies has tested student burnout in an online context in relation to overeating behaviours among Polish adolescents during the Covid-19 pandemic. Therefore, the current study aim was to examine the associations between personal and social resources, stress and burnout in the e-school environment and overeating behaviours among adolescents. Specifically, four research questions were developed to analyse this issue.

**Research question 1.** What are the relationships between social and psychological resources, e-learning burnout, and stress among students?

The theoretical foundation of the current study was based on the classical approach to human resources, namely Conservation of Resources theory (COR) [13], as well as the Study Demands-Resources theory (SD-R) [14]. The COR model identified four kinds of resources e.g. object, conditions, personal characteristics and energies. Accordingly, social relations are defined as "a resource to the extent that they provide or facilitate the preservation of valued resources, but they also can detract from individuals' resources" [15]. From this viewpoint, positive social support widens the pool of resources, and completes or replaces the lost resources [16]. COR theory suggests that the main cause of resources' loss is stress, however the person may accumulate resources (gain) to offset the net loss.

Burnout is generally regarded as a three-dimensional construct encompassing exhaustion, cynicism and reduced personal accomplishment [17]. Despite the large body of theoretical and empirical studies, there is

no agreement on the number of burnout components. For example, Santinello [18] proposed four aspects of burnout: psycho-physical exhaustion, lack of engagement, lack of self-efficacy and disillusionment. Aypay's [19] developmental approach to school burnout postulates different number of dimensions depending on educational stage e.g. four dimensions in secondary school and seven dimensions of higher education. The recently proposed BAT model excluded from Maslach's construct personal insufficiency, while it included exhaustion, mental distance (cynicism), cognitive and emotional impairment as the core components of this syndrome [20]. Taking the past theoretical approaches together, Tomaszek and Muchacka-Cymerman [21] have recently proposed to extend burnout analysis by taking into account an online learning environment context. Online school burnout was conceptualised as a student's response, to chronic online learning stressors which is constituted by five key sub-dimensions: (1) *Feeling exhausted with distance learning*, (2) *Burnout due to parental pressure*, (3) *Loss of educational interest, motivation and aspirations*, (4) *A negative attitude towards school*, and (5) *Study disappointment*. All of the above-mentioned theoretical approaches were embedded into broader concept such as the demands-resources model (JD-R) [22], which was predominantly used in the organisational context. SD-R theory is its application in the educational environment [14]. The authors postulated that school/academic characteristics may be perceived by students as study resources and study demands, and both initiate two key psychological processes: health impairment and motivational (energetic) [23]. Excessive and chronic study demands lead to a loss of mental and physical resources (energy depletion), and increased educational strains and stress. As a consequence, it activates the school burnout process, which contributes to negative outcomes e.g. low school well-being and mental health problems e.g. anxiety, depression, health risky behaviours [21, 24, 25]. Personal resources protect people from overreaching demands and the associated costs, because they stimulate active coping and facilitate goal achievement [24]. The COR theory and SD-R model are theoretical evidence for the study hypothesis listed below:

*Hypothesis 1: Social resources are positively related to psychological resources but negatively related to students stress and e-learning burnout.*

*Hypothesis 2: Psychological resources are negatively related to students stress and e-learning burnout.*

*Hypothesis 3: Students stress and e-learning burnout are positively related to each other.*

**Research question 2.** What are the differences in examined psychological characteristics related to gender and frequency of overeating behaviours?

Past investigations have confirmed that students' susceptibility to stress and burnout symptoms is heightened by gender, with girls more prone to struggling with chronic academic tension and developing school burnout syndrome [26, 27, 28]. Evidence, moreover, points to the crucial role of personality characteristics (e.g. girls' low self-esteem and self-worth, as well as resilience) in moderating the emergence of school burnout [27, 29]. Similarly, there is substantial evidence for sex differences in overeating behaviours, with females at greater risk for eating disorders and the associated negative outcomes, such as higher body weight/shape concerns; binge eating [30, 31]. It is assumed that both psychosocial, and biological factors play a critical role in this type of disorders [32]. Based on these empirical findings we formulated hypothesis 4.

*Hypothesis 4: Girls are more likely to present educational problems (stress and e-learning burnout) and overeating behaviours than boys.*

**Research question 3.** What is the prediction power of quality of social relationship, psychological well-being, e-learning burnout and stress on health risky behaviours i.e. overeating behaviours among students?

Unhealthy eating patterns are often related to marked psychological and emotional distress [31]. Furthermore, stress eating (emotional eating), is recognised as the propensity to eat in response to positive and negative emotions with no physical need [33]. The biological mechanism underlying the development of this problem is related to dysfunction of mesolimbic dopamine neurons in the reward system associated with the susceptibility to addictive substances behaviours [34]. Previous systematic reviews have revealed that poor mental health during the Covid-19 pandemic (e.g. depression, loneliness, nervousness), as well as low social support and isolation, made emotional eating more frequent [33]. In addition, the recently proposed BAT model also suggests that burnout is a mental state indicating dysregulation of emotional and cognitive systems [35]. Moreover, some studies have shown that students with burnout symptoms tend to show a high risk of developing eating disorders [36], and women with low level of burnout symptoms more frequently consume healthy food [37]. Taking into account the above-mentioned studies, we proposed hypothesis 5.

*Hypothesis 5: Poor quality of social relationships, low psychological well-being and high student stress and e-learning burnout will predict higher frequency of overeating behaviours.*

**Research question 4.** Does quality of social relationships during the Covid-19 pandemic mediate the associations between psychological well-being, e-learning

burnout and stress, and overeating behaviours among adolescents?

An extensive body of literature has shown that social relationships during adolescence period play a role of protective factors for physical and mental health issues [38]. Positive social interactions and ties buffer the adverse effects of psychological stress [39]. It is also worth adding that it is the quality of relationships, not social interactions per se, that is essential for better mental health [40]. Social support mediates the relation between depressive symptoms and pro-health activities, such as engaging in sport [41]. Moreover, Lai and Ma [38] confirmed the mediation effect of social support (family and friends relationships) on the association between life satisfaction and health risky behaviours e.g. drinking. The importance of the quality of social relationships with important others was also highlighted by Blodgett Salafia et al. [42]. The authors found that marital conflict was directly associated with girls' disordered eating, but also indirectly via poor mother- and father-adolescent relationship quality. Therefore, we assumed that psychological well-being will be indirectly related to health-risk behaviours (overeating) via social resources. Social support was also found to mediate the negative effects of burnout on health [43]. Specifically, an increase in social support and interactions at an educational institute decreases burnout and enhances well-being [39]. Importantly, recently conducted studies have found that during the Covid-19 pandemic, relationship quality decreased, and that this result was driven mostly by the emotional stressor [44]. According to Peh et al. [40], compared to no relationship, a good relationship quality was a protective factor, whereas a poor relationship quality was a risk factor for mental health during the Covid-19 pandemic lockdown. Consequently, we hypothesise that educational burnout and stress social resources will be indirectly related to overeating behaviours via relationship quality.

*Hypothesis 6: Social resources mediate the associations between psychological well-being, e-learning burnout and stress and overeating behaviours.*

## Material and methods

### Study sample and procedure

A cross-sectional quantitative online survey was conducted to test the relationships between quality of youth social relationship (social resources), well-being (psychological resources), e-learning burnout and student stress (online education resources) and health risky behaviours (i.e. overeating) among adolescents as well as the mediating effects of social and psychological resources.

The study procedure and instruments were approved by the Commission of the Ethics (WP BS-642/P/2019/20).

## Measurement tools

E-learning burnout scale (ESBS), as used in this study, was an instrument developed by the authors to capture the specificity of the Covid-19 pandemic context in the school environment. The E-SBS scale consists of 22 items grouped into five dimensions: feeling exhausted with distance learning (E), e-burnout due to parental pressure (P), loss of educational interest, motivation and aspirations (L), a negative attitude towards school (N), and study disappointment (D). Cronbach's  $\alpha$  coefficient and  $\omega$  McDonald's were acceptable for e-learning burnout total score ( $\alpha/\omega=.89$ ), and for sub-dimensions  $\alpha$  coefficient ranged between .66(N) to .85(L) [21]. The psychological well-being (PWB) was captured by using the Carroll Ryff scale (PWB), which is a well-established measurement of this construct in the literature. It consists of 18 items used to measure 6 dimensions of PBW, e.g. autonomy (AT), environmental mastery (EM), personal growth (PG), positive relations with others (PR), purpose in life (PL), and self-acceptance (SA) [45]. Cronbach's alpha coefficient and  $\omega$  McDonald's were good for the overall score of PBW ( $\alpha/\omega=.81$ ), and for sub-dimensions  $\alpha$  coefficient ranged between .42 (PL) to .73(SA). Social resources (SR) were measured with the Short scale for social resources developed by Tomaszek and Muchacka-Cymerman, that consists of 3 items estimating the quality of relationships with classmates, teachers and parents during the Covid-19 pandemic. Participants rated each item on a 3-point Likert scale (1-poor, 3-good). Cronbach's alpha coefficient and  $\omega$  McDonald's were equal to .61 and .64, respectively. The perceived students' stress (S) was estimated with one item measured on the 5-point Likert scale ranging from 1 (very low) to 5 (very high) -What is your current level of stress related to school duties? The frequency of overeating behaviours (OEB) was evaluated with one item (5-point Likert scale ranged from 1 (never or very rarely) to 5 (very often - every day).

### Reliability and validity (convergent and discriminant) of the measurements

The minimum threshold for composite reliability (CR) is .70, and all tested constructs demonstrated higher value than the above-mentioned criterion. The Cronbach's  $\alpha$  is valid at .70, however considering the small number of items,  $\alpha$  values in the range of .45 - .60 imply an acceptable value [46], and McDonald's  $\omega$  is assumed to be of acceptable values, i.e. above the minimum value of  $\omega=.50$  [47]. The convergent validity is established when AVE is equal to or greater than .50, and in this study E-SBS and SR constructs were found to meet this criterion. The AVE for PWB construct was equal to .44, which is less than the minimum value. However, if the Cronbach's alpha and CR are above 0.7, the lower AVE can be considered as

acceptable [48] (see Table 1).

The discriminant validity was measured with the heterotrait-monotrait (HTMT) criterion. In this study, HTMT ratio criterion was less than the cut-off 0.9 value for

each calculated correlation. This implied that the HTMT criterion did not detect the collinearity problems among the latent constructs (see Table 2).

Table 1. Reliability and convergent validity of the multidimensional constructs measured in the study

Construct	Indicators	Outer Loadings	CR	AVE
Social Resources (SR)	SC_1. Quality of relationship with classmates	.809	.794	.568
	SC_2. Quality of relationship with teachers	.833		
	SC_3. Quality of relationship with parents	.596		
E-Learning Burnout (E-SBS)	Factor 1. Loss of educational interest, motivation, and aspirations	.833	.835	.516
	Factor 2. E-burnout due to parents pressure	.428		
	Factor 3. Negative attitude towards school	.604		
	Factor 4. Study disappointment	.797		
	Factor 5. Study exhaustion	.838		
Psychological well-being (PWB)	Factor 1. Autonomy	.567	.824	.444
	Factor 2. Environmental mastery	.775		
	Factor 3. Personal growth	.623		
	Factor 4. Positive relations with others	.692		
	Factor 5. Purpose in life	.490		
	Factor 6. Self-acceptance	.798		

Note: CR-composite reliability; AVE-Average Variance Extracted

Table 2. Heterotrait-monotrait ratio of correlations (HTMT)

Indicators	1	2	3	4	5
1.Students Stress (S)	-				
2.Overeating behaviors (OEB)	.082	-			
3.E-learning burnout (E-SBS)	.333	.254	-		
4.Psychological well-being (PWB)	.212	.210	.319	-	
5. Social resources (SR)	.371	.345	.319	.706	-

### Normal distribution and missing data

The univariate normal distribution of the data was investigated by skewness and kurtosis (see Table 2). Mardia's coefficients of multivariate skewness and kurtosis were insignificant [49]. The presence of outliers was assessed using the Mahalanobis-squared method ( $p < .001$ ); according to the results, one observation was removed from further analysis. There were no missing data.

### Data analysis and sample size requirements

Statistical analysis were carried out using SPSS 22, and Jamovi-2.3.18.0(2023) free software. Mann-Whitney-U Test was calculated to test the differences by sex and overeating behaviours frequency due to the lack of number equality of the groups. The total sample size required for Pearson analysis was calculated with G\*Power software and was equal to 76 subjects for

conditions:  $\alpha$  (Type I error rate) = .05;  $\beta$  power (Type II error rate) = .80; Effect size equal to .60. The sample size required for logistic regression was equal to 132 (proportion of groups 0.3 vs. 0.7;  $\alpha = .05$ ;  $\beta = .05$ ) [50]. Five observed variables were included into path analysis conducted with Gallucci [51] jamovi module. Samples with normally distributed indicators and no missing data range between 100-150 are considered the minimum sample size for conducting path analysis [52, 53]. A ratio of 5 cases per variable is sufficient when latent variables have multiple indicators [54], and the rule of thumb is 10 cases per indicator variable in setting a lower bound of an adequate sample size [55].

## Results

### Descriptive statistics and Pearson's correlations

Correlation analysis revealed that in the girls' sample all tested variables were significantly interrelated (except

perceived stress (S) and overeating behaviours (OEB)). Regardless of gender, OEB was negatively correlated with psychological well-being (PWB) and social resources (SR). In the girls' sample, OEB was also positively associated with e-learning burnout (E-SBS). In the boys' sample, OEB was insignificantly correlated to both S and ESBS. The participants' perceived stress and e-learning burnout

were positively correlated in both groups, while in the girls' sample it was also negatively correlated to PWB. The strongest correlations were found between participants' social resources and PWB, which were positive and moderate in both groups (see Table 3). In summary, H1, H2 and H3 were confirmed in the girls' sample, and partially in the boys' sample.

Table 3. Pearson's correlation coefficients for coefficients for girls and boys

Variables	M(SD)	Skewness	Kurtosis	1	2	3	4	5
1.S	3.17(1.09)	-.222	-.522	-	.13	.23**	-.09	-.35**
2.OEB	2.23(1.18)	.762	-.248	.09	-	.16	-.23*	-.32**
3.ESBS	69.99(15.42)	-.225	-.527	.29**	.29**	-	-.21	-.23*
4.PWB	64.88(10.25)	-.487	.691	-.22*	-.18*	-.27**	-	.45***
5.SR	6.87(1.55)	-.327	-.778	-.18*	-.25**	-.22*	.48***	-

$p < .001$ ;  $p < .01$ ;  $p < .05$

Note: S-Students Stress; OEB- Overeating behaviors; -SBS-E-learning burnout; PWB-Psychological well-being; SR- Perceived social resources; correlations for females sample - below diagonal, for males sample - upper diagonal.

The Mann-Whitney U test was calculated to determine whether there was a difference in the examined psychological characteristics in the girls' vs. boys' sample, as well as youth with low vs. high overeating behaviours rate. The results indicated significant sex differences in perceived stress ( $z = -3.77$ ,  $p < .0001$ ), psychological well-being ( $z = -2.12$ ,  $p < .05$ ), and social resources ( $z = -2.09$ ,  $p < .05$ ) with the girls scoring higher in student stress level, and the boys scoring higher in psychological well-being and social resources. Based on the OEB score, the total

sample was divided into two sub-groups: low ( $M = 1.48$ ,  $SD = .50$ ) and high ( $M = 3.59$ ,  $SD = .76$ ) overeating behaviours, which significantly differ in frequency of presenting this health-risky behaviour ( $z = -11.73$ ,  $p < .0001$ ). The Mann-Whitney U test also detected significantly higher e-learning burnout level ( $z = -2.95$ ,  $p = .003$ ), and lower social resources ( $z = -3.75$ ,  $p < .0001$ ) among youth with high overeating behaviours (see Table 4). In summary, H4 was mostly rejected as girls presented only higher level of school stress.

Table 4. Mann-Whitney -U test results for gender and frequency of overeating behaviors differences

Variables	Gender		Overeating behaviors frequency	
	Girls (n=112)	Boys (n=74)	Low (Rarely or never) (n=120)	High (2-3 times a week or daily) (n=66)
	M(SD)	M(SD)	M(SD)	M(SD)
1.Students Stress (S)	3.44(.93)***	2.77(1.20)	3.10(1.04)	3.30(1.18)
2.Overeating behaviors (OEB)	2.17(1.16)	2.32(1.21)	1.48(.50)	3.59(.76)***
3.E-learning burnout (ESBS)	70.59(16.54)	69.11(13.62)	67.43(15.68)	74.67(13.88)**
4.Psychological well-being (PWB)	63.71(10.81)	66.66(9.13)*	65.95(9.84)	62.94(10.76)
5.Social resources (SR)	6.69(1.52)	7.57(1.57)*	7.20(1.44)***	6.27(1.58)

$p < .001$ ;  $p < .01$ ;  $p < .05$

Note: Mann-Whitney -U test p-value significance was marked;

### Logistic regression

A logistic regression was performed to ascertain the significance of the effects of gender, student stress, e-learning burnout, psychological well-being, and social resources on the likelihood that adolescents will present overeating behaviours. The regression model well fitted to the data - non-significant Hosmer-Lemeshow test value ( $p = .127$ ), and was statistically significant, chi square(1,

$N = 185$ ) = 26.08,  $p < .0001$ . The model explained 18.1% (Nagelkerke R<sup>2</sup>) of the variance in overeating behaviours and correctly classified 69.1% of cases. A high frequency of overeating behaviours was more likely in the girls' sample ( $B = -.90$ ;  $OR = 2.45$ , 95%CI [1.2, 5.01]), and with an increase in the likelihood of e-learning burnout ( $B = .03$ ;  $OR = 1.03$ , 95%CI [1.00, 1.05]), and a decrease in social resources ( $B = -.41$ ;  $OR = .67$ , 95%CI [.52, .85]). The perceived

stress and psychological well-being were not associated with overeating behaviours. In sum, H5 was partially supported, reporting only ESBS and SR as significant predictors of OEB.

**Path analysis results**

Path analysis with maximum likelihood method was conducted to analyse the direct and indirect paths between the tested variables. The model was saturated, the data fitting the present model well i.e.  $\chi^2=.345$ ,  $p=.842$ , CFI = 1.000, TLI = 1.088, RMSEA = .000 95%CI[.00, .82], and SRMR = .008. The model explained 9% of variances in OEB, 12% of variances in ESBS, and 25% of variances in SR. The findings partially supported hypothesis 6. Social resources (SR) ( $\beta=-.20$ ,  $p=.005$ ), and e-learning burnout (ESBS) ( $\beta=.18$ ,  $p=.014$ ) had a significant direct effect on overeating behaviours frequency (OEB) (see Table 5). The significant indirect effect of psychological well-being

(PWB) via SR ( $\beta= -.08$ ,  $p=.010$ ) on OEB was confirmed, however the indirect effect of ESBS via SR on OEB was insignificant. Student stress (S) had a significant indirect effect on OEB via ESBS ( $\beta=.05$ ,  $p=.041$ ), and via SR ( $\beta=.04$ ,  $p<.044$ ) (Fig.1).

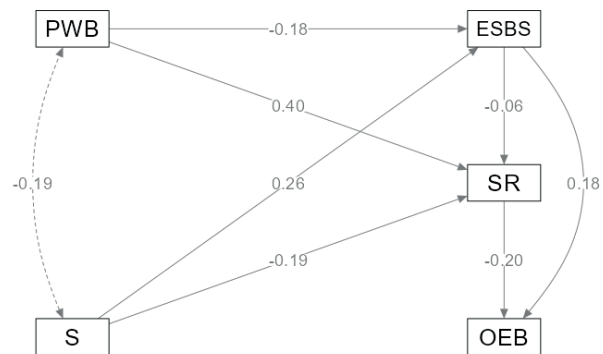


Fig. 1. Path analysis model displaying parameter estimates for mediating role of adolescent social relationships during pandemic Covid-19.

Note: S-Students Stress; OEB- Overeating behaviors; ESBS-E-learning burnout; PWB-Psychological well-being; SR- Perceived social resources

Table 5. Direct effects

DV	PV	B	SE	95%CI		$\beta$	z	p
				Lower	Upper			
OEB	SR	-.16	.05	-.26	-.05	-.20	-2.84	.005
	ESBS	.01	.01	.002	.02	.18	2.45	.014
SR	PWB	.06	.01	.04	.08	.40	6.09	<.001
	ESBS	-.01	.01	-.02	.01	-.06	-.89	.376
	S	-.27	.09	-.45	-.09	-.19	-2.87	.004
ESBS	S	3.65	.99	1.72	5.58	.26	3.70	<.001
	PWB	-.28	.11	-.50	-.07	-.18	-2.57	.010

Note: DV-dependent variable, PV – predictor; S-Students Stress; OEB- Overeating behaviors; ESBS-E-learning burnout; PWB-Psychological well-being; SR- Perceived social resources

Table 6. Indirect effects

Path	$\beta$	SE	95% CI		z	p
			Lower	Upper		
ESBS $\Rightarrow$ SR $\Rightarrow$ OEB	.01	.001	-.001	.003	.85	.398
PWB $\Rightarrow$ SR $\Rightarrow$ OEB	-.08	.004	-.02	-.002	-2.57	.010
PWB $\Rightarrow$ ESBS $\Rightarrow$ OEB	-.03	.002	-.01	.0001	-1.77	.077
PWB $\Rightarrow$ ESBS $\Rightarrow$ SR $\Rightarrow$ OEB	-.002	.000	-.001	.0001	-.80	.422
S $\Rightarrow$ SR $\Rightarrow$ OEB	.04	.021	.001	.08	2.02	.044
S $\Rightarrow$ ESBS $\Rightarrow$ OEB	.05	.024	.002	.10	2.04	.041

Note:S-Students Stress; OEB- Overeating behaviors; ESBS-E-learning burnout; PWB-Psychological well-being; SR- Perceived social resources

**Discussion**

Adolescents’ eating disorders have been profoundly affected by the Covid-19 pandemic, particularly those who experienced greater Covid-19-related stress reported more problematic eating behaviours [56]. The SARS-Cov-2 outbreak increased children’s and adolescents’ consumption of energy-dense foods, while physical activity has declined [57]. Considering the lifestyle

changes and adverse mental and physical health outcomes related to the pandemic period, the main goal of this study was to examine the associations between psychological well-being (psychological resources), relationship quality (social resources), student stress and e-learning burnout, and overeating behaviours.

The findings confirmed that psychological resources and the quality of social relationships are positively

correlated with each other (H1 was supported). E-learning burnout was negatively associated with both, personal and social resources, regardless of gender. Moreover, students' stress was related to both resources, but only in the girls' sample, while its correlation to personal resources was insignificant in the boys' sample (H2 was partially supported). Online school stress and e-learning burnout were also positively associated with each other (H3 was supported). These results empirically supported the conversation of social resources theory, in which social interactions or relationships (social resources) are recognised as "a major vehicle, by which individuals' resources are widened outside the limited domain of resources, that is contained in the self" (p.467). Our findings are also consistent with SD-R theory, which pinpointed that student burnout is caused by a depletion in study resources and an increase in overwhelming study demands [14]. Girls scored higher in student stress, while boys in psychological well-being and social resources, however, unexpectedly, no gender differences were detected in e-learning burnout and overeating behaviours (H4 was mostly rejected). These results are in line with the global trends indicating the Covid-19 pandemic affects the mental health and well-being of men and women differently, with females as the more vulnerable sex [58].

The underlying mechanism was related to different patterns of reducing negative affect induced by Covid-19 side effects. Accordingly, these adverse emotions may lead to similar non-creative activities in both sexes, but different potentially addictive behaviours and protective reactions presented by women and men. Referring to our results, although e-learning burnout (an adverse direct effect of chronic online stress) illustrates similar educational difficulties and related maladaptive coping reaction - overeating, experienced by both, girls and boys, it may be more overwhelming to girls than boys because of presenting protective reactions in the forms of social isolation and withdrawal (lower interpersonal resources), and negative beliefs about self, lack of faith in control over the environment, loss of purpose in life goals and life meaning (poorer psychological well-being). Additionally, some researchers found no gender differences in a dysregulated eating pattern (food addiction), characterised by difficulties in controlling the intake of certain foods during the Covid-19 pandemic, which may be related to the level of post-traumatic stress disorder [64]. Our results support the above findings and suggest that girls are more vulnerable to e-school stress, which may indicate a higher level of overall stress caused by social isolation and physical distance. Notably, positive relations between e-learning burnout and overeating highlighted that in an online environment chronic e-school stressors, psychological overwhelming, and social isolation during

the pandemic may play a key role in the dysregulation of young people's emotional and cognitive systems, and therefore, lead to increasing behavioural dysregulation. Such an explanation is in line with the recently developed BAT model of burnout syndrome, which points to extreme tiredness because of impairment of emotional and cognitive regulation processes – core elements of burnout – which causes mental distancing as a self-protection reaction [35].

The results of the regression model revealed that overeating behaviour predictors were as follows: gender (girls group), high e-learning burnout, and poor quality of social relationships during the Covid-19 pandemic. These characteristics explained about 18% of variances in overeating behaviours (H5 was partially confirmed). Past studies also demonstrated notable gender effects of relevance to our findings. Particularly, adolescents' stress-driven eating was more prevalent in girls compared to boys [65]. Similarly to our findings, emotional dysregulation during the Covid-19 pandemic was a risk factor for overeating disorders in the studies of McAtamney et al. [66] and Owen et al. [67]. Modrzejewska et al. [68] suggested that limited social contact, related disruptions in daily activities, and stress resulting from Covid-19 generated emotional overeating. Furthermore, social rejection and victimisation were found to be connected to a higher prevalence of emotional eating among early adolescents [60]. In accordance, despite the fact that adolescents' access to 'face-to-face' interactions with peers during the Covid-19 pandemic was limited, the results confirmed that it still played a major role in promoting and protecting the positive mental health of youth. Notably, past studies also highlighted the key role of a decrease in social connection (physical distancing and social isolation) among younger people in explaining an increase in screen time and sedentary behaviour, e.g. unhealthy diet, overweight and obesity, and poor well-being [69, 70]. Our findings are in line with the thesis mentioned above, i.e. that girls are more vulnerable to eating problematic behaviours caused by emotional distress. Moreover, the findings also supported the importance of school and family relationships as central to adolescent mental and physical health [71]. Additionally, longitudinal studies indicated that childhood experiences of family health indicators (e.g. stability and positive parent behaviours) are associated with a lack of mental health problems in adolescence [72, 73]. Hence, good parent and peer relationships, as well as a sense of connection with the school environment, contribute to both psychological well-being and health behaviours in adolescence.

Our study also explored the importance of interpersonal relations for adolescents as an important



factor for health risky behaviours (e.g. overeating) during the Covid-19 pandemic. Specifically, social resources mediated the associations between psychological well-being and overeating behaviours, as well as between students' stress and overeating behaviours. Notably, e-learning burnout mediated the relationship between students' stress and overeating behaviours (H6 was mostly supported). These observations are aligned with the classical burnout theory, in which a cynical attitude, anhedonia and tiredness, and poor efficiency are recognised as key symptoms presented by burned-out individuals [74]. This psychological profile indicates the inability to effectively use social networks and support offered by peers, family or teachers. In accordance, online learning was found to be more stressful and fearful, not only because of higher learning pressure (lower stress management and school policy) and health pressure (e.g. spending long hours in front of a screen), but also because of various forms of negative social evaluation (online exams, tests, and oral and video questioning) and social pressure from peers and families [75, 76]. Consequently, the level of perceived tension and fears cannot be ventilated in face-to-face interactions, and the individual looks for maladaptive coping strategies usually e.g. risky behaviours.

Overeating may be understood as an example of self-undermining behaviours, a part of a cycle between psychological distress, overwhelming demands, and serious negative unhealthy behaviours over time [23]. In terms of psychological and social risk factors for overeating among adolescents, past literature also pointed to the co-occurrence of eating disorders and psychosocial problems e.g. depression and social anxiety, poor relational network, and loneliness caused by the Covid-19 pandemic [60, 77]. The underlying mechanism may be connected to psychological responses to global health crises, in which elevated wariness, fears, disconnectedness and distress around loss and grief – a response to continuous life threats – manifest themselves with social withdrawal and avoidance [78]. Aligned with the existing literature demonstrating that higher stress leads to more overeating [77], the current study findings indicate that also the effect of chronic online stressors, namely burnout symptoms, are important to this type of eating disorder. Moreover, social relations were found to be a key protective factor against adolescent overeating. Having someone to turn to for information, a piece of advice, or help when facing educational or emotional problems is inevitable to maintaining mental health. On the contrary, adolescents' frustration with basic social and psychological needs during the Covid-19 pandemic may involve the signs of less healthy eating patterns, which may escalate into an eating disorder over time. Taking

into account these results, healthy coping mechanisms with online stressors and social connectedness (offline and online) should be central in intervention targets of programmes that may minimise the risk of educational difficulties, as well as eating problems.

The current study was focused on understanding the associations between psychological and social resources, remote educational difficulties and overeating behaviours. The results should be considered in light of the following study limitations. First, a small number of participants makes it impossible to generalise the results for the total adolescent population. As such, further research should include a more representative sample of adolescents. What is more, we did not divide participants into early and late adolescence, which should be taken into account as another study limitation, because age is considered a risk factor for school burnout and eating problems [79, 80]. Next, a cross-sectional method of data collection prevents drawing any causal conclusions. Accordingly, changes in individuals' levels of mental and social resources, stress and burnout, and overeating behaviours were not controlled. Thus, longitudinal studies would be more useful to fully understand the effects and the strength of these factors on overeating. In addition, the participants were surveyed in the spring of 2021, after the third wave of the pandemic in Poland (two years after the outbreak), and thus the level of measured problems might have been underestimated. For example, the self-reported measurement may cause that a student might have not recognised the level of changes in their habits and feelings during this period of time, and consider they are not overeating at all, but it is a normal amount of food they usually eat each day. As such, there may be a bias in recalling overeating. Emotional eating or loss of control over eating are complex constructs, that comprise several sub-components. For example, Meule et al. [81], distinguished five elements of emotional eating, while Latner et al. [82] proposed 13 facets of loss-of-control eating. We measured the frequency of overeating behaviours with a 1-item scale, for two reasons: (1) we tried to capture an early sign of eating problems, while the abovementioned tools allow for measuring eating disorders; and (2) we conducted our study among a non-clinical population, therefore the use of a clinical tool might have led to biased results. Despite that, the one-item tool for measuring overeating problems is one of the current project limitations, and future projects should use a method dedicated to measuring the construct of overeating as a stress-related reaction. Additionally, although prevailing literature indicates that social patterns (e.g. family, teachers, and peer support) are important to both distress and overeating, we decided to measure all these three sources of support as one social resource. However, further studies should assess

differences in relation to relatives, classmates and school environment staff.

### Conclusions

Even though we cannot conclude about causal effects, the findings suggest that Covid-19-related e-learning stress and burnout are connected to the reduction of the individuals' resources used to effectively cope with negative emotions and distress in everyday life, which, in turn, heightens the risk of unhealthy behaviours, e.g. overeating. These findings highlight the need for further prospective studies including different types of adolescents' psychological and social resources to more clearly illustrate the relationship between educational difficulties and the development of overeating behaviours. Moreover, it is important to identify whether these risk factors are generalised to all developmental periods or specified only to adolescence. In general, continued investigation spanning childhood to adulthood of virtual environmental risk factors is recommended, with an expanded emphasis on elucidating the online stressors' psychosocial mechanisms through which educational and interpersonal problems are translated into overeating. In summary, interventions and policies that aim to maintain health resources for families, peers, and schools may be beneficial in preventing overeating in the face of chronic e-learning stress and burnout.

### Ethical Approval

The study procedure and instruments were approved by the Commission of the Ethics (WP BS-642/P/2019/20).

### Conflict of interest

The authors have declared no conflict of interest.

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