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Depression and self-esteem as key factors related to academic motivation in university students

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Abstract

Background This study investigates intrinsic and extrinsic motivation among university students, focusing on how these types of motivation are shaped by a complex interaction of health, lifestyle, emotional, and psychological factors.

Methods Data were collected through an online questionnaire from 406 first- and second-year students across various universities in Lithuania, assessing their physical health indicators, lifestyle habits, personality traits, and emotional intelligence. The study was conducted from October 13, 2022 to April 17, 2023.

Results Depression was the strongest predictor of motivation outcomes. Higher depression levels were associated with increased amotivation ($\beta = 0.241$, 95% CI: 0.148–0.334, $p < .001$) and decreased intrinsic motivation ($\beta = -0.203$, 95% CI: -0.286 to -0.121 , $p < .001$). Moderate-to-vigorous physical activity (MVPA) was positively related to amotivation ($\beta = 0.179$, 95% CI: 0.072–0.285, $p = .001$), while higher math achievement predicted less amotivation ($\beta = -0.121$, 95% CI: -0.225 to -0.018 , $p = .021$). Intrinsic motivation was also influenced by higher self-esteem ($\beta = 0.199$, 95% CI: 0.071–0.277, $p < .001$). All other demographic, emotional, lifestyle, personality, sleep, and dietary factors were not significant.

Conclusions Depression was the strongest factor associated to academic motivation, leading to increased amotivation and decreased intrinsic motivation, while self-esteem, physical activity, and mathematics performance showed smaller but significant effects. Most demographic, lifestyle, emotional, personality, sleep, and dietary factors were unrelated to motivation. These results emphasize the importance of psychological well-being and academic support in boosting student motivation in higher education.

Keywords Intrinsic motivation, Extrinsic motivation, Amotivation, Emotional intelligence, Health indicators, Personality traits, Academic performance, Lifestyle habits

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Background

Motivation is undoubtedly one of the most crucial factors influencing learning efficiency, a healthy lifestyle, work productivity, creativity, and virtually all other human activities [1–7]. Motivation often varies by context: some individuals may be highly motivated in sports, others in academics, arts, music, business, politics, work, or parenting [2, 4–6]. According to self-determination theory, different types of motivation – intrinsic, extrinsic, and amotivation – coexist to varying degrees and lead to different outcomes. This theory provides a comprehensive framework for understanding the factors that foster or undermine intrinsic motivation, autonomous extrinsic motivation, and psychological well-being, all of which are directly relevant to educational settings [1–3]. Intrinsic motivation drives people to perform tasks more effectively, creatively, and joyfully [1, 2, 4, 6]. Research indicates that three innate psychological needs – competence, autonomy, and relatedness – enhance self-motivation and mental health when satisfied, and diminish motivation and well-being when thwarted [1–3]. While intrinsic, extrinsic motivation and amotivation are distinct concepts [1–3], there is no strict boundary between them.

Student academic achievement is influenced by different types of motivation derived from external incentives, ego involvement, personal values, and intrinsic interest [2, 5, 8]. Research on student learning has shown that intrinsic motivation plays a more significant role in effective learning than extrinsic motivation [1, 2, 9]. However, other studies highlight that both intrinsic and extrinsic motivations are important for effective learning [7]. Intrinsic motivation is characterized by exploratory behaviour, while extrinsic motivation is geared more towards the efficient use of knowledge [7]. Research indicates that student academic motivation is significantly influenced by academic self-efficacy and personality traits (such as extraversion, openness to experience, and conscientiousness) and is inversely related to neuroticism [10]. Students with self-determined motivation, driven by interest, curiosity, and internalized values, tend to achieve higher academic outcomes [5, 11]. A recent meta-analysis found that student competence is the strongest predictor of self-determined motivation, followed by autonomy and relatedness [11]. Other studies also demonstrate that academic motivation is highly dependent on students' perceptions of their competence to learn [12].

It is widely accepted that a combination of factors – such as physical activity [13–19], balanced nutrition [20–24], adequate rest (especially sleep) [25, 26], emotional and impulse control [14, 27]; as well as non-smoking, abstaining from alcohol, engaging in cognitive leisure activities, and meditation [28] – affect both physical and

mental health and well-being. Despite clear evidence of a positive relationship between physical activity and mental and brain health [13, 14, 18, 19], there is no conclusive evidence that physical activity directly impacts students' academic achievement [29].

Recent research on student learning motivation generally examines a limited range of motivational factors. To our knowledge, few studies investigate how the structure of intrinsic and extrinsic motivation, along with amotivation, relates simultaneously to a broader set of factors. These include health and lifestyle behaviors (e.g., body mass index, systolic blood pressure, physical activity, sedentary time, eating habits, healthy food choices, harmful habits, and sleep quality), psychological well-being indicators (subjective happiness, perceived stress, mood profiles, and self-assessed academic efficacy), personality traits, emotional intelligence, impulsivity, empathy, academic achievement, and adverse childhood experiences. Therefore, our study aims to fill this gap by identifying reliable determinants linked to intrinsic motivation, extrinsic motivation, and amotivation among university students. We hypothesize that students with higher levels of intrinsic motivation are more likely to engage in healthier lifestyle behaviors (such as increased physical activity, better sleep, and healthier food choices), report more positive emotional states, have lower stress levels, and demonstrate greater self-efficacy. We also expect they will report fewer negative developmental experiences and be less influenced by neurotic personality traits, ultimately leading to better learning outcomes. By examining these relationships simultaneously, this study seeks to improve understanding of the complex biopsychosocial factors shaping student motivation in higher education and to support the development of targeted strategies to enhance student well-being and academic success.

Methods

Participants

The study involved 406 first- and second-year university students from multiple universities in Lithuania. While 625 students were invited to participate, not all attended. The final sample included 308 females and 108 males, with an average age of 23.1 years for females and 21.9 years for males ($p = .088$). This female-to-male ratio reflects the typical gender composition of the study programs and universities involved, where female students constitute the majority. The survey gathered data on participants' age, gender, body mass index, physical activity, emotional intelligence, non-utilitarian decision making, perceived stress, depression, vigor, and happiness. Additionally, their academic performance in subjects such as mathematics, Lithuanian, English, and biology was assessed. All evaluations took place on university

grounds. The study was conducted from October 13, 2022 to April 17, 2023.

Variables and measurements

Sociodemographic and anthropometric data

Participants were asked to provide information on their age, gender, family status, education, place of residence, and financial security. Additionally, height, weight, systolic blood pressure, and waist circumference were measured. The body mass index (BMI) was calculated using the height and weight data provided by the respondents.

Happiness

The happiness was assessed using the question ‘Are you happy in life?’ with response options on a 10-point scale from 1 (“very unhappy”) to 10 (“very happy”).

Perceived stress scale (PSS-10)

The 10-item Perceived Stress Scale (PSS-10) was used to assess participants’ stress levels [30]. The PSS-10 includes 10 questions about participants’ feelings and thoughts over the past month, rated on a five-point scale from 0 to 4. Total scores range from 0 to 40, with higher scores indicating greater levels of perceived stress.

Brunel mood scale (BRUMS-LTU)

Mood responses were measured using the Lithuanian version of the Brunel Mood Scale (BRUMS-LTU), consisting of 24 items designed to assess tension, depression, anger, vigour, fatigue and confusion. For this study, we used only the Vigour subscale, which includes items such as energetic, active, lively and alert. Participants responded on a five-point Likert scale of 0 = not at all, 1 = a little, 2 = moderately, 3 = quite a bit and 4 = extremely, with total subscale scores ranging from 0 to 16 [31].

Barratt impulsivity scale version 11 (BIS-11)

Impulsivity was assessed using the Barratt Impulsivity Scale, version 11 (BIS-11) [32]. The BIS-11 consists of 30 items, grouped into three subscales: attentional impulsivity (8 items), motor impulsivity (11 items), and non-planning impulsivity (11 items). Participants responded on a four-point Likert scale, ranging from 1 (rarely/never) to 4 (almost always/always). Total scores range from 30 to 120, with higher scores indicating greater impulsivity.

Schutte self-report emotional intelligence test (SSREIT)

Emotional intelligence was assessed using the Schutte Self-Report Emotional Intelligence Test (SSREIT) [33]. It consists of 33 items, designed to assess four key components: perception of emotions, managing self-relevant emotions, managing others’ emotions and utilization of emotions. Participants rate their agreement with each statement on a 5-point Likert-type scale ranging from 1

(strongly disagree) to 5 (strongly agree). Higher scores indicate higher levels of emotional intelligence.

Student academic motivation scale (SAMS-21)

The Student Academic Motivation Scale (SAMS-21) is a 21-item questionnaire designed to assess academic motivation in students, based on self-determination theory [34]. It evaluates three types of motivation: intrinsic motivation, extrinsic motivation, and amotivation. Participants respond to each item on a 7-point Likert-type scale ranging from 1 (completely disagree) to 7 (completely agree). Higher scores in each category indicate greater levels of the corresponding type of motivation.

The big five inventory (BFI)

The Big Five Inventory (BFI), developed by John et al., 1991 [35], consists of 44 items designed for an efficient and flexible assessment of the five major personality dimensions, particularly when a more detailed measurement of individual facets is unnecessary. Participants rate each item on a 5-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly). Scale scores are calculated by averaging the item responses (i.e., summing all item scores and dividing by the number of items).

Bullying and abuse experienced in childhood

Respondents were asked, “Were you bullied as a child?” and “Did you experience a lot of physical and psychological violence as a child?”. Responses were provided on a scale from 1 to 3, where 1 = “no”, 2 = “yes”, 3 = “I don’t remember”. Additionally, we asked “If you were bullied as a child, indicate how often?” and “If you experienced physical and psychological abuse as a child, indicate how often. These responses were provided on a scale from 1 to 4, where 1 = “Very rarely”, 2 = “Rarely”, 3 = “Often”, 4 = “Very often”.

Core self-evaluations scale (CSES)

The Core Self-Evaluations Scale (CSES) was developed by Judge et al. in 2003 [36]. The CSES measures a single factor that is the communality of self-esteem, locus of control, generalized self-efficacy, and emotional stability. It is a 12-item scale and in this study a 5-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly) was used. Sample items included “I am confident I get the success I deserve in life” and “When I try, I generally succeed”. Higher total scores indicate a higher core self-esteem.

Eating habits

The frequency of consuming healthy and unhealthy food was assessed using questions based on the nutrition section of the Finbalt Health Monitor questionnaire, originally developed for an international adult

study conducted in Lithuania in 1994 [37]. Participants were asked how often they consumed various foods (fish, red meat, processed meat, fresh vegetables, canned vegetables, fresh fruits, sweets, chocolate, sweetened drinks, sugar in coffee or tea, pasta, rice, porridge, poultry, fast food, boiled potatoes, fried potatoes, eggs, biscuits, cakes, dairy products, and yogurt) over the past week. Response options included “Never”, “1–2 days”, “3–5 days”, and “6–7 days”. Breakfast consumption was rated on a scale from 1 to 3, where 1 = “no”, 2 = “sometimes”, and 3 = “yes”. Overeating was evaluated using a scale of one to three, where 1 = “no”, 2 = “rarely”, and 3 = “often”.

Academic achievement

Participants were asked to report their final exam scores in mathematics, their native language, a foreign language, and biology to assess academic performance.

Pittsburgh sleep quality index (PSQI)

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), developed by Buysse et al. [38]. The PSQI is a self-report tool that evaluates sleep quality over the past month. It provides both a global score and seven component scores: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each component is rated on a scale from 0 to 3, with a total score ranging from 0 to 21, where higher scores indicate poorer sleep quality. A total PSQI score greater than 5 has been validated as being highly sensitive and specific in distinguishing good from poor sleepers across a number of populations [39].

Harmful habits

To identify harmful habits, the respondents had to indicate their smoking habits on a scale from 1 to 4, where 1 is “I have never smoked”; 2 is “I smoke occasionally”; 3 is “I smoke every day”; 4 is “I used to smoke, but quit”. Alcohol consumption was assessed on a scale from 1 to 7, where 1 is “I don’t drink at all” and 7 is “Daily”.

Physical activity

Participants’ physical activity and sedentary behaviour (SB) were assessed using the Danish Physical Activity Questionnaire (DPAQ), which was adapted from the International Physical Activity Questionnaire (IPAQ). Unlike the IPAQ, the DPAQ refers to physical activity over the past 24 h for 7 consecutive days, instead of the past 7 days. The physical activity scale included nine levels of physical exertion, measured in metabolic equivalents (METs), ranging from 0.9 MET (sleep or inactivity) to > 6 METs (highly strenuous activities). Each level (A = 0.9 MET, B = 1.0 MET, C = 1.5 METs, D = 2.0 METs, E = 3.0 METs, F = 4.0 METs, G = 5.0 METs, H = 6.0 METs

and I > 6 METs) was described by examples of specific activities of that particular MET level and by a small drawing. Participants recorded the number of minutes (15, 30, or 45) and hours (1–10) spent at each MET activity level during an average 24-hour weekday. This enabled the calculation of total MET time, representing 24 hours of sleep, work, and leisure on an average weekday [40, 41].

Data analysis

Data analyses were performed using SPSS for Windows (IBM SPSS Statistics 29.0.2.0). Group differences in motivation scores between men and women were tested with independent-samples Welch’s t-tests. Normality was checked with Shapiro–Wilk tests and visual inspection of Q–Q plots, and variance homogeneity was evaluated with Levene’s test. Effect sizes were reported as Cohen’s *d* with 95% confidence intervals. Significance was set at $p < .05$, with false discovery rate (FDR) correction for multiple comparisons. Multiple linear regression analyses examined the unique contribution of independent variables to academic motivation outcomes (amotivation, intrinsic motivation, and extrinsic motivation). Assumptions were evaluated before modeling. Normality of residuals was checked with Q–Q plots and the Shapiro–Wilk test. Linearity and homoscedasticity were assessed using residuals-versus-fitted plots, which showed no violations. Independence of residuals was confirmed with the Durbin–Watson test (values between 1.79 and 1.98). Multicollinearity was checked with Variance Inflation Factors (VIF), all below 2, indicating little collinearity. Pairwise correlations between predictors did not exceed $|r| = 0.80$. A structured three-step GLM approach was used. First, univariate regressions identified candidate predictors ($p < .10$). Second, predictors were evaluated for multicollinearity. Third, full multivariable regression models were estimated with all predictors entered simultaneously. Results included standardized coefficients (β), 95% confidence intervals, unstandardized coefficients (B), *p*-values, Akaike Information Criterion (AIC), R^2 , and adjusted R^2 . Standardized β values were derived from *z*-scored predictors and outcomes. Additionally, Pearson partial correlation coefficients (considering gender) were calculated to assess relationships among motivation indicators.

Results

Descriptive data

Descriptive data (mean and standard deviation) are presented in Table 1. Among the participants, 41.6% did not engage in any physical activity, while 37.8% engaged in physical exercises occasionally. Students made non-utilitarian decisions in tasks involving a railway, a ship, and a virus in 73.8%, 53.5%, and 31% of cases, respectively.

Table 1 Descriptive data

Category	Mean	Std. Deviation
Healthy Lifestyle and Health-Related Indicators		
BMI (Body Mass Index)	22.8	4.3
SBP (Systolic Blood Pressure)	117.9	13.4
SB (Sedentary Behaviour), min/week	592.1	291.8
MVPA (Moderate-to-Vigour Physical Activity), min/week	158.0	45.0
(PSQI) Pittsburgh Sleep Quality Index	4.8	2.9
Red Meat, times/week	1.2	0.8
Processed Meat, times/week	1.2	0.9
Fresh Vegetables, times/week	1.8	0.9
Fresh Fruits, times/week	1.5	0.9
Sweets/Chocolate, times/week	1.3	0.8
Sugary Drinks, times/week	0.8	0.8
Fast Food, times/week	0.8	0.7
Eating while Watching TV, times/week	2.3	1.1
Snacking, times/week	1.7	1.0
Psychological Well-being		
Self-Esteem	39.5	8.3
Happiness	7.3	1.4
PSS (Perceived Stress Scale)	20.2	7.2
Moods		
Tension	6.3	4.3
Depression	5.3	4.3
Anger	8.5	4.0
Fatigue	9.3	4.7
Confusion	5.8	4.3
Vigour	7.8	3.7
Personality Traits		
Extravert	31.2	5.1
Conscientious	40.5	5.0
Agreeable	43.1	5.4
Neurotic	37.0	6.5
Open	46.1	5.2
<i>Emotional Intelligence and Impulsivity</i>		
EI total (Emotional Intelligence total)	122.8	17.9
BIS total (Impulsivity total)	65.1	10.7
Motivation		
Amotivation	2.6	1.6
Extrinsic Regulation Motivation	4.9	1.7
Extrinsic Introjection Motivation	4.2	1.8
Extrinsic Identification Motivation	5.9	1.2
Intrinsic Stimulation Motivation	4.0	1.6
Intrinsic Motivation to Achieve	4.7	1.5
Intrinsic Motivation: total	4.8	1.2
Extrinsic Motivation: total	5.0	1.1
Academic Achievements		
Mathematics	37.8	19.3
Lithuanian language	62.8	23.3
English language	69.1	23.2
Biology	62.6	20.6

In childhood, 27% of participants reported experiencing bullying, while 54.9% experienced violence. Survey data revealed that 59.2% of respondents do not smoke, 15.9% abstain from alcohol, 59.2% eat breakfast daily, and 15.9% never overeat. The study results show that men exhibit significantly higher levels of amotivation ($p < .05$) and lower levels of extrinsic motivation compared to women (Fig. 1A). Additionally, women demonstrate significantly higher extrinsic identification motivation and intrinsic motivation to learn (Fig. 1B).

Relationship between amotivation, extrinsic and intrinsic motivation

Correlation analysis indicates that intrinsic motivation to learn is significantly positively correlated with all motivation indicators, except for a significant inverse correlation with amotivation and extrinsic motivation (introjection) (Table 2). Amotivation is significantly positively correlated only with extrinsic motivation (introjection). Overall, a moderate positive correlation was found between total intrinsic and extrinsic motivation ($r = .44$; $p < .0001$). In contrast, there is a moderate negative correlation between amotivation and total intrinsic motivation ($r = -.453$; $p < .0001$), and a weaker, also negative correlation between amotivation and total extrinsic motivation ($r = -.125$; $p = .012$).

Determinants of motivation

Higher levels of depression were associated with greater amotivation ($\beta = 0.241$, 95% CI: 0.148–0.334, $p < .001$) and lower intrinsic motivation ($\beta = -0.203$, 95% CI: -0.286 to -0.121, $p < .001$) (see Table 3). Moderate-to-vigorous physical activity (MVPA) showed a positive

association with amotivation ($\beta = 0.179$, 95% CI: 0.072–0.285, $p = .001$), while higher mathematics achievement predicted lower amotivation ($\beta = -0.121$, 95% CI: -0.225 to -0.018, $p = .021$). Additionally, intrinsic motivation was predicted by higher self-esteem ($\beta = 0.199$, 95% CI: 0.071–0.277, $p < .001$). All other demographic, emotional, lifestyle, personality, sleep, and dietary factors were found to be nonsignificant. The models accounted for 10.4% of the variance in amotivation, 7.4% in intrinsic motivation, and 1.8% in extrinsic motivation.

Discussion

The present study identified several key findings regarding the factors influencing academic motivation among university students. Depression proved to be the strongest predictor, with higher depressive symptoms linked to increased amotivation and decreased intrinsic motivation, highlighting the significant effect of emotional distress on students' internal drive to learn. Self-esteem also positively predicted intrinsic motivation, emphasizing its importance in fostering autonomous engagement. Among academic performance measures, mathematics achievement was the only significant predictor, with better performance associated with lower amotivation. Moderate-to-vigorous physical activity (MVPA) showed a unique positive association with amotivation. Conversely, most demographic variables, lifestyle behaviors, emotional and stress-related states, personality traits, sleep patterns, and dietary factors exhibited no meaningful connections with motivation when analyzed together in a comprehensive multivariable model. Overall, these findings suggest that psychological functioning and academic success may have a more central role in shaping motivation than broader demographic or lifestyle

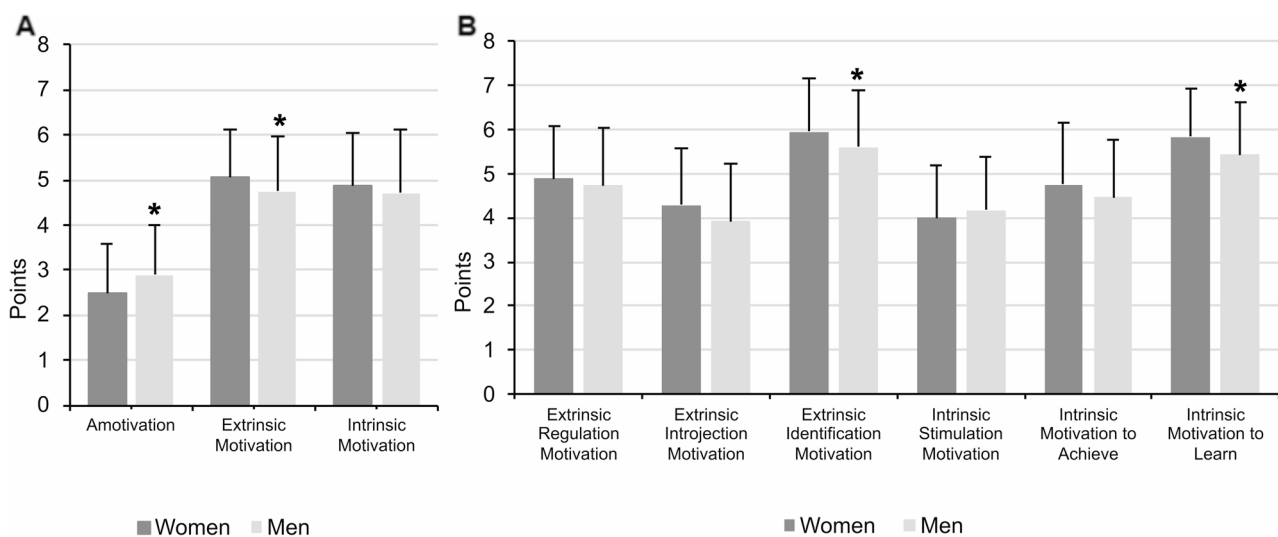


Fig. 1 Amotivation, intrinsic and extrinsic motivation of women and men (average and standard deviation) **A**, and various indicators of intrinsic and extrinsic motivations **B**. * $p < 0.05$ indicates a statistically significant test result

Table 2 Correlational relationships between components of intrinsic and extrinsic motivation

Variable	Amotivation	Extrinsic Motivation (Regulation)	Extrinsic Motivation (Introjection)	Extrinsic Motivation (Identification)	Intrinsic Motivation (Stimulation)	Intrinsic Motivation (Achievement)	Intrinsic Motivation to Learn
Amotivation	1	-0.150** (0.003)	0.319** (0.000)	-0.617** (0.000)	-0.282** (0.000)	-0.418** (0.000)	-0.518** (0.000)
Extrinsic Motivation (Regulation)	-0.150** (0.003)	1	0.336** (0.000)	0.420** (0.000)	0.322** (0.000)	0.374** (0.000)	0.220** (0.000)
Extrinsic Motivation (Introjection)	0.319** (0.000)	0.336** (0.000)	1	-0.036 (0.478)	0.079 (0.115)	0.072 (0.151)	-0.100* (0.047)
Extrinsic Motivation (Identification)	-0.617** (0.000)	0.420** (0.000)	-0.036 (0.478)	1	0.426** (0.000)	0.611** (0.000)	0.745** (0.000)
Intrinsic Motivation (Stimulation)	-0.282** (0.000)	0.322** (0.000)	0.079 (0.115)	0.426** (0.000)	1	0.665** (0.000)	0.541** (0.000)
Intrinsic Motivation (Achievement)	-0.418** (0.000)	0.374** (0.000)	0.072 (0.151)	0.611** (0.000)	0.665** (0.000)	1	0.669** (0.000)
Intrinsic Motivation to Learn	-0.518** (0.000)	0.220** (0.000)	-0.100* (0.047)	0.745** (0.000)	0.541** (0.000)	0.669** (0.000)	1

Pearson correlation values are displayed along with their significance levels (p-value in parentheses)

*p < 0.05 indicates significant correlations

**p < 0.01 indicates significant correlations

factors. Previous studies, such as those by Duckworth et al. (2019), have also shown that impulsivity is associated with poorer academic outcomes and lower motivation. Emotional dysregulation, including anger, has been linked to difficulties in academic engagement [42]. However, our study did not reveal significant associations between motivation indicators and impulsivity, mood states, emotional intelligence, or happiness. Research by Baumeister et al. (2003) supports the idea that high self-esteem is positively related to academic motivation and performance [43]. High self-esteem prospectively predicts success and well-being in life domains such as relationships, work, and health [44]. This partially aligns with our findings, as self-esteem was the only determinant directly associated with intrinsic motivation. Bullying can damage self-esteem and increase anxiety, leading to greater amotivation [45]. However, in our case, neither bullying nor violence demonstrated significant associations with any of the motivation determinants.

We also observed that student amotivation was significantly associated with lower mathematics achievement, whereas no meaningful relationships were found between amotivation and performance in other academic subjects, indicating that motivational deficits may be particularly salient in mathematics-related learning contexts.

Unexpectedly, none of the dietary products or eating habits demonstrated significant associations with any

of the motivation indicators. According to research, the consumption of less healthful food groups is associated with poorer academic achievement in elementary school-children [46]. For instance, Bleiweiss-Sande et al. (2019) found that a greater intake of less healthful food groups (such as sweet snacks, salty snacks, and sweetened beverages) was linked to lower scores on English standardized tests. However, a recent comprehensive analysis by the EAT-Lancet Commission indicated that there is little high-quality, strong causal evidence regarding the effects of individual foods on cognitive function across the life course [47].

Research consistently shows that happiness, vigour, and self-esteem are closely linked to psychological well-being, and these factors are inversely related to perceived stress and depression [48]. Psychological well-being is a multifaceted concept that includes positive relationships with others, autonomy, purpose in life, and personal growth, all of which are significant components [49]. Zhao et al. (2021) found a direct relationship between self-esteem and academic achievement in school [25]. However, O'Brien et al. (2006) argue that most self-esteem researchers never claimed that self-esteem would be a strong predictor of complex behaviours such as academic performance [50]. Interestingly, neither physical activity, sedentary behaviour (SB), nor BMI were significantly

Table 3 Standardized β coefficients (95% CI) from full multiple regression models predicting academic motivation dimensions

Predictor (Independent Variable)	Amotivation	Intrinsic Motivation	Extrinsic Motivation
Gender	–	–	–
Body Mass Index	–	–	–
Systolic Blood Pressure	–	–	–
Smoking	–	–	–
Alcohol consumption	–	–	–
Breakfast frequency	–	–	–
Overeating	–	–	–
Snacking	–	–	–
Fast-food intake	–	–	–
Eating while watching TV	–	–	–
Perceived Stress Score (PSS)	–	–	–
Depression	+ 0.241 (95% CI: 0.148–0.334), $p < .001$	–0.203 (95% CI: –0.286 to –0.121), $p < .001$	–
Happiness	–	–	–
Anger	–	–	–
Fatigue	–	–	–
Confusion	–	–	–
Energy	–	–	–
Moderate-to-Vigorous Physical Activity	+ 0.179 (95% CI: 0.072–0.285), $p = .001$	–	–
Sedentary behavior	–	–	–
Sleep quality (PSQI total score)	–	–	–
Bullying frequency	–	–	–
Violence frequency	–	–	–
Mathematics grade	–0.121 (95% CI: –0.225 to –0.018), $p = .021$	–	–
Lithuanian language grade	–	–	–
English language grade	–	–	–
Biology grade	–	–	–
Red meat consumption	–	–	–
Processed meat consumption	–	–	–
Fresh vegetables	–	–	–
Fresh fruit	–	–	–
Sweets and chocolate	–	–	–
Sweetened drinks	–	–	–
Impulsivity (BIS total)	–	–	–
Personality traits	–	–	–
Extraversion	–	–	–
Agreeableness	–	–	–
Conscientiousness	–	–	–
Neuroticism	–	–	–
Openness	–	–	–
Self-esteem	–	+ 0.199 (95% CI: 0.071–0.277), $p < .001$	–
Adjusted R ²	0.104	0.074	0.018

associated with intrinsic motivation (total) or any of its three components.

Surprisingly, our study also showed a positive relationship between physical activity and amotivation—more physically active students tended to be less academically motivated, potentially indicating that engagement in sports or other physical pursuits may compete with or divert focus away from academic goals. Typically,

physical activity is linked to better academic performance and higher motivation [51–53].

Moreover, research indicates that personality traits significantly influence vigour and self-esteem, with vigour and well-being being positively related to extraversion and negatively related to neuroticism [54, 55]. Tabbodi (2015) found a positive correlation between happiness and academic achievement [56]. Other studies have shown that adverse childhood experiences

affect well-being, learning, and health [57]. Duke (2010) found that gender and the type of adverse childhood experiences, including exposure to violence, were significant factors in the relationship between self-esteem and adverse experiences [58]. Chen et al. (2022) demonstrated that psychological well-being and emotions play a crucial role in students' learning motivation [59]. Additionally, research has shown associations between utilitarian judgment and negative mood, particularly depression [60]. Further studies suggest that self-esteem can significantly impact relationships at school and work, mental health, physical health, and antisocial behaviour [61]. Research shows that mental health is significantly correlated with achievement motivation, and academic achievement depends on achievement motivation [62].

This study has several limitations, including its reliance on self-reported measures of lifestyle factors and dietary habits, which may be subject to recall bias, social desirability bias, or misreporting. Additionally, the cross-sectional design prevents any inference of causality, and the correlations identified cannot establish mechanistic causal links between motivational indicators and the variables examined, as these relationships may be reciprocal or influenced by unmeasured confounders. The sample was drawn from a specific age group and cultural context, which may limit its generalizability to broader or more diverse populations. Moreover, the sample was predominantly female, which may have influenced the observed patterns of association and reduces the applicability of the findings to male or more gender-balanced groups. Furthermore, motivational constructs were assessed at a single time point, preventing evaluation of temporal dynamics or developmental trajectories. It is also important to recognize that our statistical models only explained a small portion of the variance in motivational outcomes (10.4% for amotivation, 7.74% for intrinsic motivation, and 1.18% for extrinsic motivation), suggesting that other unexamined psychological, social, and contextual factors likely play significant roles. Future longitudinal studies incorporating objective behavioral measures and experimental designs would help strengthen the evidence base and clarify potential mechanisms. Additionally, multiple theoretical perspectives exist regarding the mechanisms underlying intrinsic, extrinsic, and amotivational processes, extending beyond the self-determination framework that primarily guided our interpretation. Our focus on self-determination theory may not fully capture the complexity of motivational dynamics, as other models—such as expectancy–value theory, achievement goal theory, or social–cognitive approaches—identify additional factors not included in our analysis. Consequently, motivational processes should be understood within a broader theoretical context. Despite these limitations, the study's strength

lies in revealing how intrinsic and extrinsic motivation are influenced by a broad range of factors. These include not only lifestyle factors (such as physical activity, sedentary behaviour, sleep quality, healthy food choices, eating habits, smoking, and alcohol consumption), physical health, and psychological well-being, but also mood indicators, impulsivity, emotional intelligence, non-utilitarian decisions, personality traits, academic achievements, and adverse childhood experiences. We hope this research has expanded the understanding of the factors that most strongly influence students' intrinsic and extrinsic motivation to learn. Importantly, the study adopts an integrative biopsychosocial perspective and provides one of the most comprehensive examinations of motivational determinants specifically among university students to date.

Conclusions

This study offers new evidence on the multifactorial nature of academic motivation among university students, showing that depressive symptoms, self-esteem, physical activity, and mathematics achievement are key predictors of motivational outcomes. In contrast, impulsivity, mood states, emotional intelligence, happiness, bullying, violence, dietary habits, physical activity levels, sedentary behavior, and BMI were not significantly linked to intrinsic or extrinsic motivation, highlighting the selective importance of certain psychological and academic factors. Although the models' explanatory power was limited, the findings emphasize the vital role of mental health and academic performance in shaping motivation. By integrating a wide range of biopsychosocial factors, this research enhances understanding of the complex mechanisms behind motivation in higher education and lays the groundwork for future longitudinal and experimental studies aimed at boosting student well-being and academic achievement.

Abbreviations

BFI	Big Five Inventory
BIS	Barratt Impulsivity Scale
BMI	Body Mass Index
BRUMS-LTU	Lithuanian version of the Brunel Mood Scale
CSES	Core Self-Evaluations Scale
EI	Emotional Intelligence
MVPA	Moderate-to-Vigorous Physical Activity
PSQI	Pittsburgh Sleep Quality Index
PSS	Perceived Stress Scale
SAMS	Student Academic Motivation Scale
SB	Sedentary Behaviour
SBP	Systolic Blood Pressure
SSREIT	Schutte Self-Report Emotional Intelligence Test

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Authors' contributions

DM: Writing – writing –original draft, Writing – review & editing, Conceptualization, Methodology, Visualization, Supervision; NI: Writing – review & editing, Formal Analysis; DV: Writing – review & editing, Formal

Analysis, Data curation; RD: Writing – review & editing, Formal Analysis; AS (Sidlauskienė): Writing – review & editing, Formal Analysis; TA: Writing – review & editing, Formal Analysis; IEJ: Writing – review & editing, Formal Analysis; ES: Writing – review & editing, Formal Analysis; RZ: Writing – review & editing, Formal Analysis, Data curation; MG: Writing – review & editing, Formal Analysis, Data curation; AS: Writing – review & editing, Formal Analysis, Data curation; AS (Skurvydas): writing – original draft, Writing – review & editing, Conceptualization, Methodology, Supervision.

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Data availability

The datasets used and analysed during this study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Human Research Ethics Committee at Klaipėda University (2022-12-15 Protocol No. STIMC-BTMEK-09). All participants were informed of the purpose of the research and that the information provided in the anonymous survey will be used for research purposes. A written informed consent was obtained from all participants involved in the study, no compensations for participating in the study were given, and all processes were in accordance with the Helsinki Declaration of 1975.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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