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SUBJECTIVE VITALITY AMONG UNIVERSITY STUDENTS: A PREDICTIVE STUDY OF CIRCADIAN RHYTHM AND INDIVIDUAL FACTORS

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ABSTRACT

Subjective vitality is a reflection of the psychological energy and well-being of students. The purpose of this study was to investigate the relationship between disruptions to circadian rhythms and individual characteristics in predicting subjective vitality among college students. This study examined circadian rhythm disturbance and individual characteristics such gender, age, academic major, GPA, health condition, and residency as predictors of subjective vitality in university students. A survey was done using validated instruments, specifically the Subjective Vitality Scale (α = 0.87) and the SBRDA for circadian rhythm disturbance (α = 0.95). The study focused on 547 university students and was conducted in a cross-sectional manner. Both predictors and indirect effects were put through their paces using mediation models and multiple regression analyses. A total of 4.7% of the variance in subjective vitality was explained by the model, as indicated by the results (R^2 = 0.047, p < .001). Gender (β = 0.111, p = .005), health status (β = 0.101, p = .009), and habitation type (β = -0.120, p = .023) were found to be significant predictors in accordance with the statistical analysis. However, specialization and grade point average exhibited strong relationships with circadian disruption as a mediator. The mediation analysis revealed that there were no significant indirect effects that occurred as a result of the disruption of the circadian rhythm. Subjective vitality can be directly predicted by gender, health status, and living situations, Gender, health status, and living arrangements directly predict subjective vitality. Interventions addressing circadian regulation and health could enhance student vitality and academic outcomes.

KEYWORDS: Subjective Vitality, Circadian Rhythm, Predictors, University Students, Multivariate Analysis.

1. INTRODUCTION

Subjective vitality energy, aliveness, and ability to handle daily challenges indicates psychological and physical well-being (Ryan et al., 2010)University students face academic and social expectations that might impact their health and daily functioning; hence, there is increased interest in subjective vitality. Daily performance and energy regulation depend on circadian rhythms. Recent research shows that evening chronotypes are more prone than morning chronotypes to suffer sleep issues, bedtime postponement, and daily fatigue, which affects their subjective vitality. Males report more vitality than females, and vitality declines with age (Singh et al., 2023) Off-campus students slept less, lowering their energy and vigor ((Tonetti et al., 2015) Health-promoting activities also impact chronotype and subjective vitality, according to research. Healthy habits link biological and psychological rhythms, enhancing energy and well-being (Chao, 2023; Zhu et al., 2022)However, we need to conduct studies on the hypothesized relationship between circadian rhythms, individual characteristics, and subjective vitality, particularly in colleges with high academic and social demands. Subjective vitality defined as a positive feeling of aliveness and energy serves as a robust indicator of eudaimonism well-being and physical health among university students Digital Commons Given its strong links to psychological functioning, identifying predictors of vitality has significant implications for student mental health (Wallace, 2011) The term "subjective vitality" refers to an individual's experience of having energy and liveliness (Cheng & Wong, 2025)Subjective vitality is a key part of psychological well-being and health-related quality of life. The idea of self-determination, which was created by Ryan and Deci (2002) , is the foundation upon which subjective vitality functions as a latent variable. According to this idea, the foundation for healthy life functioning is comprised of behavioral will and autonomous self-regulation responsibilities. Experiencing a depletion of energy can result in feelings of aggravation, restlessness, and exhaustion, all of which are potential symptoms of psychiatric problems. There is a possible correlation between a lower subjective vitality and the development of symptoms related to both physical and mental health, according to Ryan et al. (2010) Due to the developmental processes that take place at this stage of life, adolescence is characterized by a high prevalence of sleep and circadian rhythm disorders (Carskadon et al., 2004)For the purpose of promoting high levels of attention and cognitive performance during the wake period, as well as to prevent physiological alterations that may predispose individuals to unfavorable health outcomes, it is vital to have sleep that is of sufficient duration, continuity, and intensity (depth) without disrupting the circadian rhythm. (Goel et al., 2013). Subjective vitality is an important aspect of psychological well-being and health-related quality of life, it refers to an individual's perception of having energy and liveliness (Cheng & Wong, 2025) Subjective vitality, as a latent variable, is rooted in the self-determination theory developed by Ryan and Deci (Ryan & Deci, 2002). Within this theory, behavioral will and autonomous self-regulation form the basis for optimal life functioning. A depletion of vitality can lead to feelings of irritation, restlessness, and fatigue all of which can be indicators of psychiatric disorders Lower subjective vitality may be associated with the development of physical and mental health symptoms (Ryan et al., 2010) Sleep and circadian rhythm disturbances are very common in adolescence, due to the developmental processes that occur at this stage of life(Carskadon et al., 2004) Sleep of sufficient duration, continuity, and intensity (depth) without circadian disruption is necessary to promote high levels of attention and cognitive performance during the wake period, and to prevent physiological changes that may predispose individuals to adverse health outcomes. (Goel et al., 2013). "Vitality is having the physical, cognitive, and social capacities to do what you want" Vitality has capacities and life drivers, it included physical, cognitive, and social capacities. Vitality depended on maintaining these three capacities, Life was driven by liberty, freedom, and significance, Their vitality was primarily defined by the balance between their capacities and life drivers, Lifestyle, loss of social networks, coping, and role models can all affect balance and vitality (Jongeneelen et al., 2025) It is hypothesized that "one's conscious experience of possessing energy and aliveness" is what is meant to be represented by the concept of subjective vitality, which was developed by Ryan and Frederick (1997, page 530). Subjective vitality is a humanistic concept that was informed by earlier work on self-actualization and self-determination. It is influenced by both psychological and physical elements, and it is, to some extent, a consequence of an individual's internal appraisal of themselves as a self-regulating entity (Miksza et al., 2021). Sleep and rhythm changes cause a phase shift in sleep time toward later hours, resulting in progressively severe sleep deprivation in adolescents between 10 and 20 years old, with 40.5% of 15-year-olds reporting sleep deprivation. The social environment, particularly school, intensifies

these shifts by preventing adolescents from adhering to their later circadian preference, or 'chronotype.' The 'social jetlag' is the difference between sleep–wake rhythms on 'free days' (when the adolescent can follow his or her generally delayed internal temporality) and school days(Rolling et al., 2024) Circadian rhythm may affect vitality. The Morning Ness–Evening Ness Questionnaire (MEQ) and its shorter form (rMEQ) accurately assess chronotype morning, intermediate, or evening preference, which coincides with biological markers including body temperature and MDPI. Evening chronotypes have more social jet lag, unpredictable sleep, and lower academic focus in the morning. The study of 3,423 Chinese undergraduates found 43% experienced inadequate sleep. Circadian rhythm (rMEQ) increases healthy cultures (HPLP-II) and decreases poor sleep (PSQI). Wellness lifestyles were found to affect circadian rhythm and sleep quality by 13.3%. Healthy habits may aid sleep. (Phillips et al., 2017)These disruptions are known to adversely affect mood, mental health, and overall well-being (Goel et al., 2013; Jankowski, 2013). Apart from chronotype, lifestyle and physical activity determine subjective vitality. Regular exercise boosts energy and vitality in female students. Investigation Psychiatry Digital Commons Sedentary behavior and uneven daily routines delay circadian timing and lower academic performance (Phillips et al., 2017) Vitality, resilience, and quality of life have also been linked to demographic and psychological factors like GPA, residence, gender, and physical health. Positive health practices and stable living environments improve sleep and circadian alignment, which may boost vitality(Henrich et al., 2023) Chronotype matters when examining behavioral sleep quality determinant (Burke et al., 2015) Internal circadian rhythms determine a person's chronotype, which includes sleep and activity routines, Evening chronotypes favor late activity and sleep. Circadian timings fluctuate from early in childhood to late in adolescence, culminating around 20. A second chronotype change marks the end of adolescence (Roenneberg et al., 2004)The evening chronotype is linked to poorer sleep (Vitale et al., 2015) Evening types are more likely to experience depressive symptoms (Kivelä et al., 2018) and sleep quality mediated this connection in a student population (Van den Berg et al., 2018). All diurnal species are alert during the day and sleepy at night due to hormone regulation by the master clock. Sleep begins when melatonin rises before bedtime. In contrast, cortisol rises before waking to signal the night–day shift. The master clock generates endogenous signals that contradict homeostatic sleep drive to promote daytime alertness and overnight drowsiness (Nagare et al., 2021). A cross-sectional study (Grasaas et al., 2023) of 696 adolescents (13–15 years) found longer weekend sleep (10:09 h) than schoolday sleep (08:36 h). Schooldays sleep duration was positively associated with HRQOL subscales psychological well-being, autonomy, school environment, and self-efficacy. Mediation analysis showed schooldays sleep explained 64–75% of these associations. Adequate schoolday sleep is essential for adolescent well-being. In a study of music students, stress was identified as a significant negative predictor of vitality, while adaptability and quality of peer relationships were positive predictors (Miksza et al., 2021) However, these factors did not moderate the effects of stress on vitality. The study (Eker & Yıldırım, 2022) of 1,040 Ege University students found above-average resilience (mean ARS: 120.23 ± 17.54) and that 63% had an intermediate chronotype. Gender, school, income, health, and chronotype explained 21.9% of resilience variance. Chronotype and demographics partially influenced resilience. Over 21 days, 32 university students were assessed for chronotype-related temporal organization discrepancies. Activity/rest, sleep/wake, wrist temperature, attention, and light exposure cycles were measured. The rhythms' acrophores correlated with Horne & Östberg Questionnaire scores, but not light exposure metrics. Evening students with morning classes showed social jet lag and disrupted attention rhythms, indicating difficulties adapting to university schedules.(Duarte & Menna-Barreto, 2022)The study(Zhang et al., 2023) of 3,423 Chinese undergraduates found 43% experienced inadequate sleep. Circadian rhythm (rMEQ) increases healthy cultures (HPLP-II) and decreases poor sleep (PSQI). Wellness lifestyles affected circadian rhythm-sleep quality 13.3%. Healthy habits may aid sleep. Tong et al. (2023) studied 4,768 Anhui undergraduates. The Morningness–Eveningness Questionnaire (MEQ-19) and Pittsburgh Sleep Quality Index (PSQI) revealed that evening chronotypes (51.17%) were most prevalent and significantly linked to lower sleep quality in latency, duration, efficiency, and daytime dysfunction (OR=1.671–2.149) . Zhu et al. (2022) examined chronotype and sleep quality in 2,822 Chinese students. Evening types had the worst sleep and most bedtime procrastination compared to morning and intermediate kinds. Bedtime procrastination largely mediated the chronotype sleep quality association, but sleep hygiene awareness moderated it. Chao (2023) examined

health-promoting lifestyles in Taiwanese students and found that individual factors major, GPA, health perception were linked to vitality and psychological outcomes, highlighting lifestyle as a mediator between chronotype and vitality. Monma et al. (2025) reported that bedtime procrastination was closely tied to evening chronotypes, poor sleep, and daytime fatigue suggesting diminished vitality and productivity. Arastoo et al. (2024) found that sleep disturbances were linked to poorer academic performance and reduced energy among medical students, with evening chronotypes serving as a risk factor. Fudolig et al. (2024)using wearable devices found that most first-semester students displayed evening chronotypes, chronic sleep debt during term time, and disrupted daily rhythms impacting energy and activity. Roy et al. (2025) observed that evening chronotypes, despite initially poorer habits, showed gradual improvements in routine and vitality over a year thanks to personalized feedback via Oura rings. Calderón et al. (2021) found that adolescents with very late chronotypes experienced pronounced social jet lag and difficulties regulating daytime energy due to delayed sleep-wake timings. Subjective vitality is a key indicator of psychological and physical well-being, although most research has focused on its links to lifestyle factors including physical activity and health habits. Circadian rhythms particularly chronotype differences interact with demographic and psychological factors to predict university student vitality, although little is understood. Social jet lag, impaired cognitive performance, and reduced well-being are more common in evening-type people due to institutional schedule misalignment, but few studies have directly examined how circadian misalignments affect subjective vitality, Academic stress and unpredictable sleep-wake patterns worsen circadian disruption and lower energy and vitality in university students, The subjective vitality model using circadian rhythm (rMEQ), health-promoting behaviors (HPLP-II), and individual variables (e.g., gender, GPA, residence, physical disease) has not been extensively studied. Building targeted interventions that promote circadian alignment and lifestyle adjustment to boost student energy and academic success requires addressing this gap, this study examines how circadian rhythm, individual variables, and health-promoting behaviors influence subjective vitality to fill this gap.

2. METHODOLOGY

2.1. Research Design

This study employed a descriptive-analytical design to identify the predictive factors of self-vitality among university students. A structured electronic questionnaire was developed using Google Form to enable effective data collection and broad participant access. The survey included clear instructions on the study purpose and assured participants of the confidentiality of their responses, which would be used exclusively for academic research. The survey link was distributed through university emails and official student communication channels after securing ethical approval from the institutional research ethics committee.

2.2. Participants

The survey included 547 college students from different colleges and fields of study. We used stratified random sampling to choose participants. This means that we split the population into groups depending on gender, age, and area of study. To assure that all subgroups were fairly represented, a random sample was taken from each stratum in proportion to how many people were in the whole population. The sample includes students who were in both undergraduate and graduate programs and had been in school for at least one year to make sure they had enough experience with university life. People who said they had chronic physical or mental health problems that could impair their self-vitality levels were not allowed to take part. An electronic questionnaire sent out through university emails and official student communication platforms was used to collect data. People could choose to take part, and they gave their informed consent after being given explicit instructions and ethical considerations for the study. We didn't include responses that were incomplete or that had random answering patterns in order to keep the data quality high. Table 1 shows the full details of the study participants. Table 1 shows the descriptive statistics for the 547 people who participated in the study. Most of the sample (80.6%) were men, whereas only 19.4% were women. The majority of the people who took part (79.0%) were between the ages of 19 and 22, followed by those between the ages of 23 and 25 (16.1%), and a lesser number (4.9%) were older than 25. More than half of the participants (51.7%) were studying humanities, 31.8% were studying religious sciences, and 16.5% were studying medical sciences. 51.2% of the people who took part had an exceptionally high GPA, 34.7% had a very good GPA, and 14.1% had a decent GPA. It's interesting to note that 20.1% of the sample said they had chronic ailments, while 79.9% said they didn't. Most of the people who participated (93.6%) lived with their families. Only a tiny number

(1.6%) lived with friends or in other arrangements (4.8%).These traits suggest that the sample is mostly young, male, and academically successful, with a lot of people coming from humanities fields and a large number living with their families.

Table 1: Demographic Characteristics of the Study Sample.

Variable	Category	Frequency (n)	Percent (%)
Gender	Male	441	80.6
	Female	106	19.4
Age	19–22	432	79.0
	23–25	88	16.1
	Above 25	27	4.9
Specialization	Medical Sciences	90	16.5
	Religious Sciences	174	31.8
	Humanities	283	51.7
GPA	High Excellent	280	51.2
	Very Good	190	34.7
	Good	77	14.1
Chronic Diseases	Yes	110	20.1
	No	437	79.9
Residence	With Family	512	93.6
	With Friends	9	1.6
	Other	26	4.8

3. INSTRUMENTS

1. 1.The Subjective Vitality Scale (SVS), created by Bostic et al. (2000), is a psychological test that measures a person's subjective sense of vitality, which is the internal feeling of energy, alertness, and enthusiasm that shows how healthy they are both mentally and physically. After getting rid of one negatively phrased item that didn't do well on the psychometric test, the scale now has six questions that are worded positively. Respondents allocate each item a score on a 7-point Likert scale, with 1 being "not at all true" and 7 being "very true." Adding up all the things provides you a total score, with higher scores meaning more subjective vitality. the psychometric features of the scale were checked for the current investigation. The validity coefficient (adjusted item-total correlations) was between 0.61 and 0.78, while the reliability coefficient (Cronbach's Alpha) was 0.87. This shows that the items were quite consistent and reliable.
2. The biological rhythm disruption was assessed using the Sleep, Behavior, and Rhythmicity Disruption Assessment (SBRDA) developed by Xie et al. (2023) There are a total of 29 items included in this instrument, which are arranged in four basic categories: (1) Sleep (items 4–9), (2) Diet (items 14–21), (3) Daily Activities (items 1–3, 10–13), and (4) Use of Digital Media (items 22–29). Participants were asked to report the degree to which their biological rhythms had remained stable over the course of the previous thirty days. A Likert scale of five points, ranging from one (completely inconsistent) to five (completely consistent), is used to assign a rating to each individual topic. The overall score is determined by adding up all of the components, which results in a composite score that can range anywhere from 29 to 145. Higher scores indicate a larger degree of disruption to the biological rhythms of the organism. It is also possible to compute subscale scores for each dimension by adding up the items that correspond to that dimension. For the purposes of this study, the psychometric features of the SBRDA were validated. Indicating an extraordinarily high level of internal consistency and providing evidence for the scale's usefulness for research and therapeutic applications, the reliability coefficient, also known as Cronbach's Alpha, was determined to be 0.950.

3.1. Data Collection and Statistical Analysis

For the purpose of collecting data from the study sample, validated instruments were utilized, and the psychometric properties of these instruments were validated prior to the beginning of the data collection process. It was ensured that the participants' privacy and confidentiality were safeguarded by the fact that all of the surveys were completed electronically by the participants within the specified time limit. The JASP software was applied in order to perform the analysis on the data. In order to provide a brief overview of the data, descriptive statistics such as means and standard deviations were also computed. This was done in order

to provide a succinct summary of the data. The methodology of Cronbach's alpha was utilized in order to investigate both the validity coefficients and the internal consistency. Through the utilization of item-total correlations, the validity coefficients were ultimately obtained. In addition, multiple regression analysis was performed in order to analyze the hypotheses that were being tested in the study and to investigate the predictive power of the independent variables on the variables that were dependent on them.

4. RESULTS

1. The level of subjective vitality among university students can be predicted by biological rhythm disruption, health status, age, gender, residence, field of study, and GPA.

Table 1: Model Summary of the Multiple Linear Regression.

Model	R	R^2	Adjusted R^2	RMSE
M_1	0.217	0.047	0.035	7.164

The results presented in Table 1 demonstrate that the multiple linear regression model (M), which took into account factors such as gender, age, specialization, grade point average, illnesses, and residence, was able to account for 4.7% of the variance in self-vitality scores ($R^2 = 0.047$). The model also showed a minor improvement in the root mean square error (RMSE = 7.164) when compared to the model that might be considered the null hypothesis (M1).

Table 2: ANOVA for the Regression Model.

Model	Source	Sum of Squares (SS)	df	Mean Square (MS)	F	p
M_1	Regression	1,732.543	9	192.505	3.751	< .001
	Residual	34,947.365	681	51.318		
	Total	36,679.907	690			

The results presented in Table 2 demonstrate that the regression model M□ had statistical significance ($F(9, 681) = 3.751$, $p < .001$). The fact that this is the case shows that the collection of independent variables makes a considerable contribution to the overall prediction of self-vitality among college students individually.

Table 3: Regression Coefficients for Predicting Self-Vitality.

Predictor	B	SE	Standardized β	t	p
Intercept	27.383	1.342		20.402	< .001
Gender	1.678	0.598	0.111	2.808	.005
Age	-0.476	0.567	-0.036	-0.839	.402
Specialization (Islamic Sciences)	0.323	0.921		0.351	.726
Specialization (Human Sciences)	1.514	0.826		1.832	.067
GPA (Very Good)	-0.265	0.611		-0.434	.664
GPA (Good)	-1.753	0.891		-1.969	.049
Diseases (No)	1.918	0.738		2.601	.009
Residence (With Friends)	0.179	2.220		0.081	.936
Residence (Other)	-3.008	1.321		-2.276	.023

The results presented in Table 3 indicate that the presence of diseases (B = 1.918, p = .009), gender (B = 1.678, p = .005), and other forms of dwelling (B = -3.008, p = .023) were significant predictors of self-vitality. Statistical significance was not achieved by any of the other predictor types.

Table 4: Residual Statistics of the Regression Model.

Statistic	Minimum	Maximum	Mean	Standard Deviation (SD)
Predicted Value	24.148	33.696	30.988	1.585
Residual	-25.182	17.845	-5.771×10^{-17}	7.117
Standardized Predicted Value	-4.317	1.709	1.047×10^{-15}	1.000
Standardized Residual	-3.543	2.516	-6.401×10^{-5}	1.002

4.1. There are Statistically Significant Mediation Relationships and Direct and Indirect Effects between the Independent Variables and Subjective Vitality, as Tested using Mediation Analysis

Table 5: Direct Effects of Predictors on Subjective Vitality.

Predictor	Estimate (B)	Std. Error	z-value	p-value	95% CI Lower	95% CI Upper
Gender	0.230	0.081	2.823	**0.005**	0.070	0.389
Specialization	0.116	0.054	2.150	**0.032**	0.010	0.222
Diseases	0.290	0.094	3.100	**0.002**	0.107	0.474
Residence	-0.199	0.088	-2.274	**0.023**	-0.371	-0.028

The direct effects presented in Table 1 indicate significant contributions of gender, specialization, previous diseases, and residence to subjective vitality. These findings align with the total effects shown in Table 2, confirming the robustness of these predictors. Notably, specialization and GPA, while not significant in direct effects, emerge as important predictors of the mediator Sleep, Behavior, and Rhythmicity Disruption Assessment (SBRDA) in Table 3, suggesting potential indirect influences not reflected in vitality scores.

Table 6: Total Effects of Predictors on Subjective Vitality.

Predictor	Estimate (B)	Std. Error	z-value	p-value	95% CI Lower	95% CI Upper
Gender	0.225	0.081	2.780	**0.005**	0.066	0.384
Specialization	0.109	0.053	2.059	**0.040**	0.005	0.212
Diseases	0.292	0.094	3.125	**0.002**	0.109	0.476
Residence	-0.195	0.087	-2.232	**0.026**	-0.366	-0.024

The total effects in Table 6 reinforce the significant direct relationships reported in Table 5 The persistence of these effects even when considering potential mediation suggests that the mediator Sleep, Behavior, and Rhythmicity.

Disruption Assessment (SBRDA) does not play a substantial role, which is consistent with the non-significant indirect effects (not tabulated here). This pattern underscores the direct pathways as the dominant mechanisms influencing subjective vitality.

Table 7: Path Coefficients between Predictors and Morning-Evening Personality.

Predictor	Estimate (B)	Std. Error	z-value	p-value	95% CI Lower	95% CI Upper
Specialization	0.250	0.045	5.506	**< .001**	0.161	0.339
GPA	0.688	0.048	14.319	**< .001**	0.594	0.782

Table 3 highlights strong associations of specialization and GPA with the mediator, Sleep, Behavior, and Rhythmicity Disruption Assessment (**SBRDA**). However, as seen in Tables 1 and 2, these variables do not translate into significant indirect effects on vitality, emphasizing that while they influence the mediator, this pathway does not contribute meaningfully to subjective vitality outcomes.

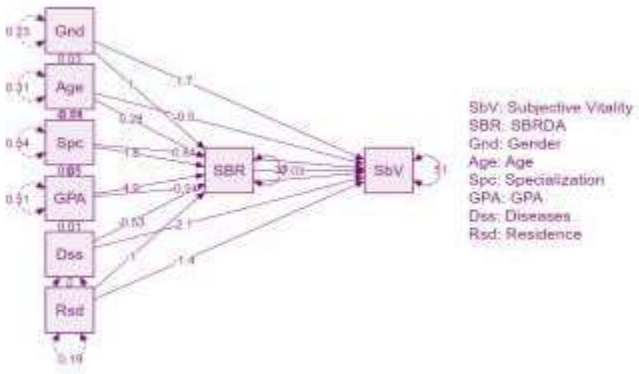

Figure 1: Path Diagram of Direct and Indirect Relationships between Study Variables.

The path diagram illustrates the direct relationships of gender, specialization, previous diseases, and residence with subjective vitality, as confirmed in Tables 5 and 6. It also displays the indirect pathways via Sleep, Behavior, and Rhythmicity Disruption Assessment (SBRDA).which were found to be statistically non-significant, consistent with the findings in Table 7.

5. DISCUSSION

According to the findings of the current research, the factors of gender, health condition, and type of dwelling were found to be important direct predictors of the level of subjective vitality among college students. To be more specific, male students reported higher levels of vitality than female students; students who were in outstanding health displayed higher levels of vitality; and students who lived away from their family demonstrated lower levels of vitality. This finding is consistent with the findings of other researchers, including Singh et al.

(2023) who highlighted gender differences in vitality due to biological and social factors; Chao (2023)who demonstrated that overall good health predicts greater subjective vitality by enhancing both physical and psychological functioning; and Tonetti et al. (2015) who discovered that students residing off-campus suffer from poorer sleep quality, negatively impacting their energy levels. However, these results go against what Henrich et al. (2023)found, which showed no major gender differences in vitality when considering psychological resilience and social support; (Miksza et al., 2021) who pointed out that peer relationships and psychological adaptability are more important than demographic factors; and Eker and Yıldırım (2022), who found that lifestyle choices and physical activity influence how health affects vitality. The research team believes that this result can be read via the lens of Self-Determination Theory (Ryan et al., 2010)This theory proposes that satiating fundamental psychological needs, such as relatedness, autonomy, and competence, can lead to an increase in one's subjective vitality. Factors such as good health and supportive living environments directly influence these demands. Conversely, social expectations could contribute to gender differences instead of solely biological differences. Moreover, the Social Jetlag Model Roenneberg et al. (2004)may provide an explanation for the diminished vitality of students who are living away from their homes as a result of sleeping and waking schedules that are interrupted. A disruption in the circadian rhythm was not shown to be a major mediator between individual characteristics and subjective vitality among university students, according to the findings of the current study. Despite the fact that both specialization and grade point average were found to have a high association with circadian rhythm disruption as a mediator, these associations did not transfer into significant indirect impacts on vitality levels. This finding is consistent with the findings of Arastoo et al. (2024)who reported that the influence of circadian rhythm on subjective vitality decreased when students adopted healthy sleep habits and regular physical activity; Fudolig et al. (2024) who discovered that students developed psychological and behavioral coping strategies that mitigated circadian disruption; and Roy et al. (2025), who observed gradual improvements in students' routines and vitality, especially among evening chronotypes, after receiving personalized feedback. Zhang et al. (2023)emphasized that circadian rhythm mediates vitality by affecting sleep quality; Zhu et al. (2022) showed that evening chronotypes experience poorer sleep quality and bedtime procrastination, which leads to reduced vitality; and Tong et al. (2023) found that evening chronotypes are prevalent among Chinese undergraduates and are associated with lower sleep quality and vitality. These findings, however, appear to contradict the findings of Zhang et al. The research team believes that this outcome may be explained by the ability of students to adopt adaptive techniques such as rescheduling their study and sleep hours, particularly within the context of flexible university environments. They contend that this is in line with the Self-Determination Theory Ryan et al. (2010) which states that students who have a high level of intrinsic drive are able to adjust for circadian disruptions by effectively managing their time and being responsible with their conduct. Additionally, this is consistent with the Social Jetlag Model Roenneberg et al. (2004) which proposes that the consequences of circadian misalignment might be mitigated by the utilization of coping mechanisms. In this investigation, the prediction model explained only 4.7% of subjective vitality scores (R^2 = 0.047, p <.001). This suggests that gender, health condition, and residence directly affect student vitality, but not enough to explain most of the variances. This finding supports Wallace (2011),Ryan et al. (2010), and Henrich et al. (2023) lth behaviors and social support significantly explain vitality variance. This contradicts Cheng and Wong (2025) who found that models incorporating mental health, physical activity, and circadian rhythm explained over 20% of the variance, and Zhang et al. (2023) , who found that adding health-promoting lifestyle behaviors as a mediator greatly improved their model's predictive power. The research team thinks the restricted variance indicates subjective vitality's multifaceted, multidimensional nature, which encompasses self-motivation, social interactions, and daily behaviors. They suggest adding social support, psychological resilience, and daily routines to future models. This supports Self-Determination Theory (Ryan et al., 2010) and Bronfenbrenner's Ecological Systems Theory (1979), which states that multiple environmental levels (personal, familial, community) affect psychological health and vitality.

5.1. Difficulties & Limitations

It is possible that the interpretation and extrapolation of the findings of this investigation could be affected by the constraints that were found in the study. The limited sample of university students from a specific setting severely compromised the external validity of the results. In addition, the use of self-reported surveys, although they are practical and frequently utilized, may be

susceptible to biases such as social desirability and recollection mistakes. These factors can affect the accuracy of the responses, so they should be considered when analyzing the results. The cross-sectional design, which does not allow for the establishment of causal correlations between variables, is another weakness of the study. Although the predictive analyses provided valuable insights, longitudinal studies would offer stronger evidence regarding the temporal and directional nature of these associations. In order to further validate and extend these findings, it is recommended that future research incorporate a wider range of people, incorporate objective measurement equipment, and make use of modern statistical methodologies.

6. CONCLUSION

The findings of this study, despite the fact that it had certain methodological and contextual constraints, provide useful insights into the elements that influence the subjective vitality of university students. These findings provide a basis for future research that will have the ability to adopt more diverse samples, longitudinal designs, and objective techniques in order to gain a deeper understanding of the causal linkages between variables. Addressing these challenges will strengthen the reliability of findings and expand their applicability across psychological, educational, and health contexts.

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