DOI: 10.4274/gulhane.galenos.2025.60320
Gulhane Med J 2025;67(4):277-284

Social jetlag increases energy intake independent of ultra-processed food consumption in young adults

Mahmut Bodur, Ecem Nur Sakar, Gül Duru Aydın

Ankara University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Türkiye

Cite this article as: Bodur M, Sakar EN, Aydın GD. Social jetlag increases energy intake independent of ultra-processed food consumption in young adults. *Gulhane Med J.* 2025;67(4):277-284.

Date submitted:
30.03.2025
Date accepted:
06.11.2025
Publication Date:
11.12.2025

Corresponding Author:
Mahmut Bodur, Asst. Prof., Ankara University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Türkiye
mahmutbodur@ankara.edu.tr

ORCID:
orcid.org/0000-0002-2105-8485

Keywords: Diet, energy intake, social jetlag, ultra-processed foods

ABSTRACT

Aims: The aim of this study was to investigate the relationship between social jetlag (SJL), ultra-processed food (UPF) consumption, and total energy intake in young adults.

Methods: This cross-sectional study included 648 healthy individuals aged 18-30 years. SJL was assessed using the Munich Chronotype Questionnaire and categorized into three groups: <1 hour, 1-2 hours, and >2 hours. Dietary intake was evaluated using a 24-hour dietary recall. UPF consumption was determined using a NOVA-based food frequency questionnaire. Multiple linear regression analyses were performed to evaluate the associations, adjusting for age, sex, body mass index, physical activity, smoking status, and total energy intake.

Results: Total energy intake was significantly higher in the SJL ≥2 hours group (1698.7±34.8 kcal/day) compared to the SJL <1 hour (1474.3±44.1 kcal/day) and the 1≤ SJL <2 hours (1582.3±33.9 kcal/day) groups ($p<0.001$). Participants with SJL ≥2 hours had significantly higher macronutrient intake, including fat, saturated fat, carbohydrate, and protein, compared with those with SJL <1 hour ($p<0.05$). No significant association was found between SJL duration and UPF consumption when modeled as a continuous variable (B=-0.0024; 95%, CI:-0.0124 to 0.0076; p=0.636). Age was inversely associated with UPF consumption (B=-0.0097; 95%, CI:-0.0154 to -0.0040; p=0.001), indicating lower UPF intake with increasing age. No other variables were significantly associated with UPF consumption ($p>0.05$).

Conclusions: SJL is associated with increased energy and macronutrient intake in young adults, independent of UPF consumption.

Introduction

Social jetlag (SJL), defined as the discrepancy between an individual's biological and social clocks, arises from differences in sleep timing between workdays and free days (1). This misalignment is prevalent in modern society, particularly among young adults; approximately 50% experience at least two hours of SJL and 70% report a misalignment of at least one hour (1,2). SJL has been linked to various adverse health outcomes, including obesity, depression, diabetes, and cardiovascular disease, suggesting its potential role in metabolic dysfunction (3-5). In addition to these metabolic and physiological risks, SJL has been associated with psychosocial consequences, including increased stress, impaired academic performance, reduced subjective well-being, and poor mental health outcomes, particularly in young populations (4,6). While the mechanisms underlying these associations remain an area of ongoing investigation, recent studies suggest that one such mechanism may involve dietary behaviors. Individuals experiencing greater SJL have been observed to consume more ultra processed food (UPF) and sugar-sweetened beverages and to have lower intakes of nutrient-dense foods such as fruits, vegetables, whole grains, and legumes (6-9). These dietary patterns are of particular concern given their well-established links to obesity, insulin resistance, and other metabolic disorders (3). However, evidence on this topic remains limited, with some studies failing to establish a consistent association between SJL and dietary intake (10-12). Given that SJL is influenced by cultural, occupational, and societal structures, its prevalence and impact may differ across regions. In Türkiye, a limited number of studies have addressed the relationship between SJL and dietary habits in young adults, suggesting similar patterns to those observed in Western societies (13). However, comparisons across different socio-cultural contexts highlight the need for region-specific evidence, as variations in lifestyle, work schedules, and social norms may influence the expression and consequences of SJL (14-16). Given their accessibility, palatability, and tendency to be consumed during irregular or late-night eating episodes, UPFs may serve both as a consequence of and as a contributor to the irregular dietary patterns associated with circadian misalignment. These characteristics make UPFs particularly relevant in the context of SJL. Moreover, UPFs are consistently associated with poor dietary quality and increased metabolic risk. Despite these potential links, the relationship between SJL and UPF intake remains unclear, with mixed findings reported in different populations (10,17,18). Therefore, this study aims to examine the relationship among SJL, UPF consumption, and total energy intake in young adults.

Methods

Study design, participants and ethics

This cross-sectional study included healthy adults aged 18-30 years living in Ankara. Based on prior studies (13,17), eligible participants were those who were within the specified age range, had no chronic disease or psychological disorders, were not using regular medications or dietary supplements, were not pregnant or breastfeeding, and were not students of the department of nutrition and dietetics. Individuals who did not meet these criteria were excluded.

The sample size was determined using statistical power analysis. The analysis was conducted with a Type I error (α) of 0.05, a statistical power (1-β) of 0.85, and a medium effect size (0.20). Based on these parameters, at least 640 participants were required. The study was approved by the Ankara University Ethics Committee (approval no.: 06/53, date: 16.04.2024), and all procedures were conducted in accordance with the Declaration of Helsinki.

Data collection

Participants were recruited between April and June 2024 through announcements posted on bulletin boards across various faculties at Ankara University. Those who expressed interest were contacted and invited to the department of nutrition and dietetics outpatient clinic. After providing written informed consent, eligible individuals completed all assessments during a single visit under the supervision of trained research staff. Each data collection session lasted approximately 30-45 minutes.

Assessment of social jetlag

The Munich Chronotype Questionnaire (MCTQ), developed by Roenneberg et al. (18), was used to assess SJL in participants. This questionnaire includes items measuring biological clock characteristics, morning and evening activity levels, weekday and weekend sleep patterns, exposure to daylight, and SJL. The Turkish adaptation of the MCTQ was validated by Erdoğan et al. (19), who confirmed its reliability and applicability in the Turkish adult population.

SJL was calculated as the absolute difference between mid-sleep on free days and mid-sleep on workdays; mid-sleep was defined as the midpoint between sleep onset and wake time, and all measures were derived from responses to the MCTQ (1,19). Participants were then categorized into three groups: <1 hour, 1-2 hours, and >2 hours, according to previous studies (20,21).

Dietary intake assessment and determination of ultra-processed food consumption

A 24-hour dietary recall was conducted by researchers to assess participants' food and beverage consumption. To improve accuracy in estimating portion sizes, the food and beverage photo catalog was used (22). The Nutrition Information System (BEBIS) software was used to analyze participants' energy, macronutrient, and micronutrient intake. BEBIS is a computerized dietary analysis program widely used in Türkiye by dietitians and researchers to assess nutrient intake and plan dietary interventions. The software contains an extensive Turkish food composition database with over 20,000 food items and more than 130 nutrient components, including macronutrients, vitamins, minerals, amino acids, and fatty acids (23). Additionally, a food-frequency questionnaire was developed to assess the consumption of UPF over the past month based on the NOVA classification, in which category 4 includes UPF (Appendix 1) (24). These were further categorized into ultra-processed snacks, ultra-processed beverages, and other UPFs. The NOVA classification categorizes foods according to the extent and purpose of industrial processing. It includes four groups: unprocessed or minimally processed foods, processed culinary ingredients, processed foods, and UPFs. UPFs, which correspond to group 4, are industrial formulations typically made from five or more ingredients. These foods often contain additives such as colorants, flavorings, emulsifiers, sweeteners, and preservatives that are not commonly found in domestic kitchens. Examples include packaged snacks, sugar-sweetened beverages, instant noodles, reconstituted meat products, and ready-to-eat frozen meals. The NOVA system is widely used in nutritional epidemiology to investigate the associations between food processing levels and various health outcomes (25).

Statistical Analysis

All statistical analyses were conducted using IBM SPSS Statistics version 25 (IBM.Corp., Armonk, NY, USA). The normality of continuous variables was assessed using both the Kolmogorov-Smirnov and Shapiro-Wilk tests, supported by visual inspection of histograms and quantile-quantile plots. Extreme outliers, particularly in nutrient intake variables, were examined carefully. Implausible values identified as data entry errors were corrected or excluded, and sensitivity analyses were performed with and without these outliers. After these adjustments, the assumption of normality was reasonably met, and parametric tests were applied. Pearson correlation analyses were performed to identify potential covariates for regression modeling and to assess collinearity among continuous variables. Group differences were analyzed using the independent samples t-test, while comparisons across three or more groups were conducted using one-way analysis of variance (ANOVA). For variables with a statistically significant ANOVA ($p<0.05$), Bonferroni post-hoc tests were applied to identify differences between groups. For multivariable analyses, linear regression models were applied, with a significance level set at $p<0.05$.

To account for total energy intake when evaluating UPF consumption, the residual method was applied. A linear regression model was constructed with UPF consumption as the dependent variable and total energy intake (kcal) as the independent variable. The residual values obtained from this model represented deviations from expected UPF consumption based on energy intake, allowing an energy-independent comparison. Since residual values could be negative, min-max normalization was applied to standardize all values to the range (0,1). The resulting variable was used as the dependent variable in further analyses. Model fit was evaluated by reporting R^2 and adjusted R^2 as indicators of the regression models' explanatory power.

To evaluate the impact of SJL on UPF consumption, multiple linear regression analyses were performed. SJL was analyzed as a continuous variable (measured in hours). To control for potential confounders, the model included total energy intake (kcal), age, sex, smoking status, body mass index (BMI), and physical activity level (PAL). To improve comparability with research and minimize the influence of any residual confounding, total energy intake (kcal) was retained as a covariate in the regression models, even though UPF consumption had already been adjusted for energy intake using the residual method

Results

Demographic characteristics of participants

The demographic characteristics of the participants are presented in Table 1. There were no statistically significant differences among the groups with respect to age, sex, smoking status, BMI, BMI categories, or PAL ($p>0.05$ for all comparisons).

However, significant differences were observed in nutrient intake across the SJL groups. Total energy intake was significantly higher in the SJL ≥2 hours group (1698.7±34.8 kcal/day) compared to the SJL <1 hour (1474.3±44.1 kcal/day) and the 1≤ SJL <2 hours (1582.3±33.9 kcal/day) groups ($p<0.001$). Similarly, protein intake was highest in the SJL ≥2 hours group (65.6±1.7 g/day), showing a significant difference between groups ($p=0.046$).

Fat intake and saturated fatty acid (SFA) intake also increased with increasing SJL duration, with the SJL ≥2 hours group having the highest intakes ($p=0.025$ and $p=0.011$, respectively). Carbohydrate (CHO) intake was significantly lower in the SJL <1 hour group and increased across groups, reaching the highest values in the SJL ≥2 hours group ($p<0.001$). In contrast, fiber intake showed a decreasing trend, with significantly lower levels in the SJL ≥2 hours group ($p=0.022$). Although sodium intake appeared higher in the SJL ≥2 hours group, the difference was not statistically significant ($p=0.122$).

Energy and nutrient intake from ultra-processed foods by social jetlag group

Energy and nutrient intakes from UPFs across SJL categories are presented in Figure 1. Analysis of energy intake from UPFs indicates that packaged snacks, chips, cookies, cakes, protein bars, and ice cream contribute most to total UPF-derived energy. A clear increase in energy intake from these food groups was observed with increasing SJL duration (Figure 1a). Regarding protein intake from UPFs, the highest contributions were from chocolate-flavored drinks, protein bars, and processed meats. In particular, participants with SJL duration ≥2 hours had higher protein intake from processed meats than other groups (Figure 1b). In terms of fat intake, the primary UPF sources were chips, cakes, ice cream, and processed meat products. Fat intake, particularly from processed meats and margarines, increased with longer SJL duration (Figure 1c). For CHO intake, the most significant contributions came from chips, cakes, sweetened beverages, and chocolate-flavored drinks. CHO intake from chocolate-flavored drinks and sugary beverages increased substantially with increasing SJL duration (Figure 1d). Regarding sodium intake, processed meats, chips, and fast-food items were the primary UPF sources. Notably, participants with an SJL duration of 2 hours had higher sodium intake from processed meats and instant soups compared with other groups (Figure 1e). Finally, an evaluation of SFA intake from UPFs showed that the largest contributors were ice cream, cakes, margarine, and

Table 1. Demographic characteristics of participants

Characteristic	SJL <1 hour (n=129)	1< SJL <2 hours (n=212)	SJL >2 hours (n=307)	p-value
Age (years)	21.1±2.3	21.1±2.7	21.1±2.5	0.985
Sex				
Female	105 (81.4)	157 (74.1)	241 (78.5)	0.253
Male	24 (18.6)	55 (25.9)	66 (21.5)	
Smoking status				
Smoker	44 (34.1)	51 (24.1)	89 (29.0)	0.130
Non-smoker	85 (65.9)	161 (75.9)	218 (71.0)	
BMI (kg/m²)	22.2±3.4	22.1±3.2	22.0±3.2	0.328
BMI category				
Underweight	15 (11.6)	25 (11.8)	39 (12.7)	0.929
Normal weight	89 (69.0)	152 (71.7)	219 (71.3)	
Overweight/obese	25 (19.4)	35 (16.5)	49 (16.0)	
PAL	1.4±0.1	1.4±0.1	1.4±0.1	0.886
Nutrients				
Energy intake (kcal/day)	1474.3±44.1[a] (645.1-2436.5)	1582.3±33.9[a] (639.6-2934.4)	1698.7±34.8[b] (841.1-3692.4)	**<0.001**
Protein intake (g)	58.6±2.3[a] (16.5-161.5)	62.3±1.6[a] (20.0-162.4)	65.6±1.7[b] (16.4-248.1)	**0.046**
Fat intake (g)	66.0±2.3[a] (14.0-139.0)	68.9±1.8[a] (14.8-146.5)	73.6±1.8[b] (15.2-214.0)	**0.025**
Saturated fatty acids (g)	23.6±0.9[a] (3.7-52.1)	24.97±0.70[a] (2.6-63.1)	27.0±0.7[b] (6.5-78.3)	**0.011**
Carbohydrate intake (g)	157.4±5.8[a] (35.1-400.0)	174.1±4.7[a] (32.7-468.5)	188.6±4.4[b] (32.9-455.5)	**<0.001**
Fiber intake (g)	13.8±0.7[a] (1.4-40.2)	15.5±0.5[b] (0.9-42.7)	15.9±0.4[b] (3.9-59.8)	**0.022**
Sodium intake (mg)	2121.1±111.6 (161.6-7991.9)	2512.5±84.6 (375.4-7177.0)	2801.4±253.9 (355.1-7619.7)	0.122

Values are presented as mean ± standard deviation (minimum–maximum) or frequency (percentage), as appropriate.
Different superscript letters ([a, b]) indicate statistically significant differences between groups ($p<0.05$), determined by one-way ANOVA followed by Bonferroni post-hoc test for continuous variables, and chi-square test for categorical variables
SJL: Social jetlag, BMI: Body mass index, PAL: Physical activity level

processed meats. As SJL duration increased, SFA intake from margarines increased notably, while a smaller increase was observed for processed meats (Figure 1f).

Effect of social jetlag duration on ultra-processed food consumption

Table 2 presents the multiple linear regression results evaluating the effect of SJL duration (in hours) on UPF consumption. The model was adjusted for total energy intake (using the residual method), age, sex, smoking status, BMI, and PAL and included 95% confidence intervals for all predictors.

The results show that SJL duration was not significantly associated with UPF consumption (B=-0.0024; 95% CI: -0.0124 to 0.0076; p=0.636). Among all predictors, age was the only variable significantly associated with UPF intake (B=-0.0097; 95% CI: -0.0154 to -0.0040; p=0.001), indicating that UPF consumption decreases with increasing age. No other variables, including sex, smoking status, BMI, or PAL, were significantly associated with UPF consumption (p>0.05 for all). The final sample size for the regression analysis was n=648. The model explained approximately 3.5% of the variance in UPF consumption (R^2=0.035; adjusted R^2=0.025).

These findings suggest that while SJL does not appear to influence UPF consumption directly, age-related factors may play a more prominent role in shaping dietary patterns, particularly with respect to UPF intake.

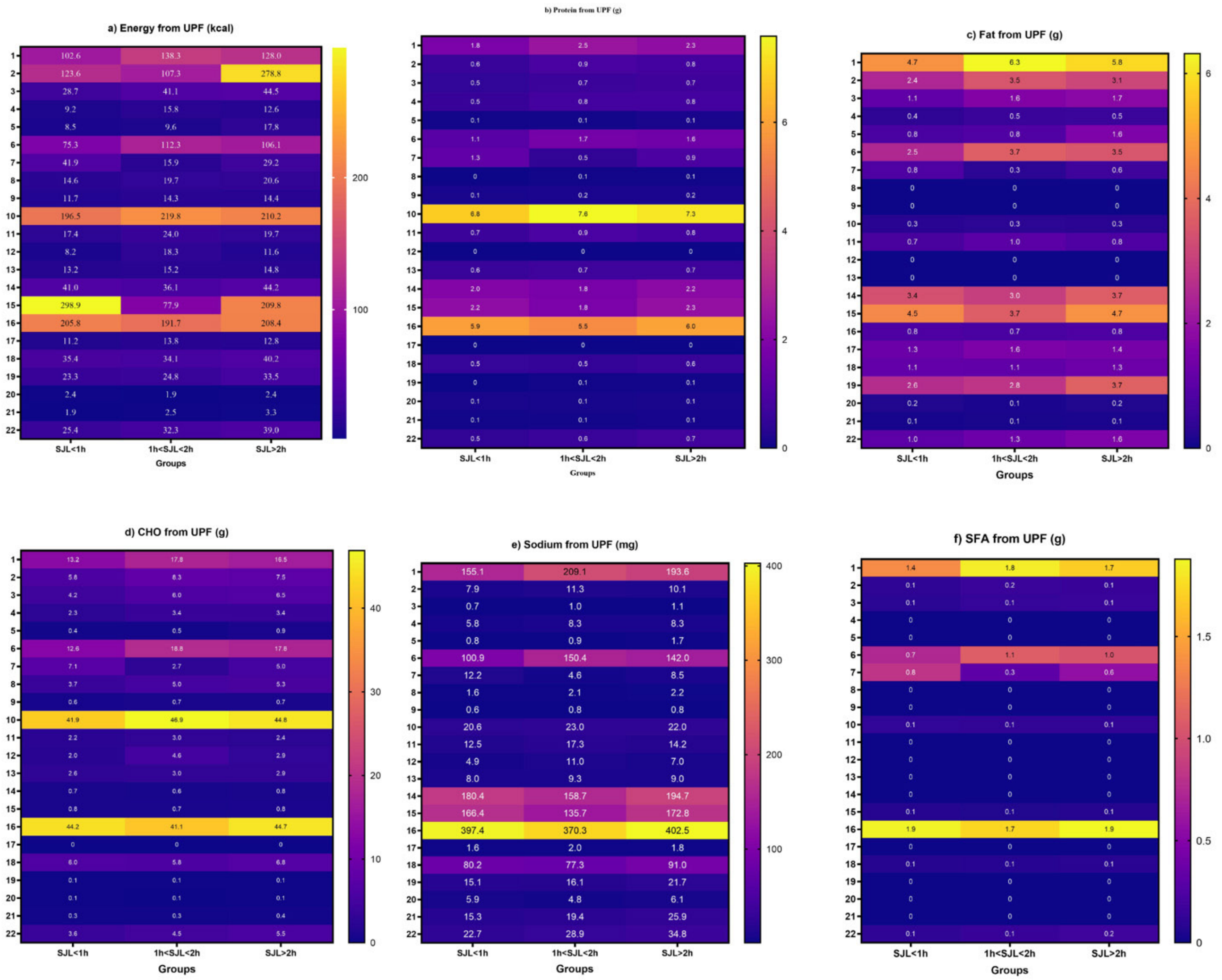

Figure 1. Heatmaps of energy and nutrient intake from ultra-processed foods across social jetlag categories

Panels represent intake levels of (a) energy (kcal), (b) protein (g), (c) fat (g), (d) carbohydrate (g), (e) sodium (mg), and (f) saturated fatty acids (g) from ultra-processed foods, stratified by social jetlag groups (SJL <1 hour, 1-<2 hours, ≥2 hours). Color intensity indicates relative intake levels, with higher values shown in warmer tones. Rows represent individual ultra-processed food items listed in Appendix 1.

CHO: Carbohydrate, UPF: Ultra processed food, SFA: Saturated fatty acid, SJL: Social jetlag

Table 2. Multiple linear regression results for the effect of social jetlag (continuous) on ultra-processed food consumption

Variable	B (Beta)	SE	95% CI	p-value
Constant	0.6748	0.1078	0.4635, 0.8861	**<0.001**
SJL duration (hours)	-0.0024	0.0051	-0.0124, 0.0076	0.636
Energy (kcal)	-0.000001	0.000013	-0.0000, 0.0000	0.937
Age	-0.0097	0.0029	-0.0154, -0.0040	**0.001**
Gender	-0.0295	0.0189	-0.0665, 0.0075	0.120
Smoking	0.0247	0.0237	-0.0217, 0.0711	0.304
BMI	0.0031	0.0044	-0.0055, 0.0117	0.486
PAL	-0.0325	0.0189	-0.0695, 0.0045	0.092

Values represent unstandardized regression coefficients (B), standard errors, 95% confidence intervals, and p-values. Social jetlag was included as a continuous variable (in hours). The model was adjusted for total energy intake (using the residual method), age, gender, smoking status, BMI, and PAL. The final sample size for the regression analysis was n=648. Model fit statistics: R^2=0.035; adjusted R^2=0.025

SE: Standard error, CI: Confidence interval, SJL: Social jetlag, BMI: Body mass index, PAL: Physical activity level

Discussion

The study found that SJL is associated with dietary intake, particularly higher total energy and macronutrient intake. However, no significant association was observed between SJL and UPF consumption after adjusting for confounders.

Daily energy intake was higher among individuals with longer SJL duration. This suggests that misalignment between internal circadian timing and external social obligations may disrupt energy homeostasis and adversely affect metabolic health. These are consistent with previous studies linking SJL to components of the metabolic syndrome, including abdominal obesity and insulin resistance (5,16). With increasing duration of SJL, the intake of protein, total fat, SFA, and CHOs increased significantly. This suggests that circadian disruption affects not only energy intake but also other aspects of dietary intake. Of specific concern is the increased intake of SFA, given its role as a risk factor for cardiovascular disease (10). Furthermore, dietary fibre intake was significantly higher among individuals with SJL ≥2 hours ($p=0.022$). This finding contrasts with several previous studies reporting reduced fibre intake among those experiencing SJL and may reflect context-specific dietary patterns among young adults in Türkiye (14,15). This contrasts with findings by Al Khatib et al. (6), who reported reduced fibre consumption among individuals experiencing SJL. The difference may be attributable to cultural and dietary factors or to methodological variations. Collectively, these results suggest that SJL is associated not only with greater energy intake but also with poorer diet quality. Although descriptive analyses indicated increased energy intake from UPFs with greater SJL duration, the multiple regression analysis showed no statistically significant direct association between SJL and UPF consumption. This is consistent with other studies, although results have been inconsistent (26,27). While the present study did not directly examine the influence of SJL on UPF consumption, younger individuals consumed significantly more UPFs, consistent with previous reports (28,29).

Age appeared to have a protective effect on UPF consumption, as older participants reported lower intake levels. The observed age-related difference in UPF consumption supported the hypothesis that younger age groups may be more susceptible to unhealthy dietary behaviours, possibly due to socio-temporal constraints associated with education and employment (28,29).

While SJL was not identified as an independent determinant of UPF consumption, its indirect associations with diet quality suggest that SJL may influence dietary patterns rather than specific food choices (14,15). Compared with previous research, this study demonstrates the complexity of the relationship between SJL and dietary behaviour. The variability observed across cultural contexts, age demographics, and methodological approaches may be a contributing factor to the inconsistencies reported in the literature (15,27). In high-income countries, UPF consumption shows substantial heterogeneity based on socio-demographic indicators such as education, income, and immigration status (26).

The present study has some strengths and limitations. Firstly, the relatively large sample size enhances the statistical power and generalizability of the findings to young adult populations. Second, a comprehensive set of validated instruments was used to assess key study variables, including the MCTQ for SJL, a 24-hour dietary recall to assess nutrient intake, and a NOVA-based food frequency questionnaire for UPF consumption. The residual method was used to adjust UPF intake for total energy intake, thus minimising confounding and enabling a more accurate interpretation of UPF consumption patterns. Furthermore, the implementation of multiple regression models, controlling for potential confounders such as age, sex, smoking status, BMI, and PAL, increases the robustness of the results. Despite these strengths, several limitations should be considered. The cross-sectional design limits causal inference regarding the association between SJL and dietary behaviours. The potential for recall bias and under- or overestimation of food intake is a further limitation arising from the use of self-reported dietary data. The single-day dietary recall may not accurately show habitual intake, particularly for nutrients with high day-to-day variability. SJL was assessed using self-reported questionnaires rather than objective sleep measures (e.g., actigraphy), which may reduce measurement precision. The study population was restricted to healthy adults aged 18-30 years, which may limit the generalizability of the findings to other age groups or clinical populations. Finally, the study did not assess temporal eating patterns or meal timing, which may mediate the relationship between SJL and dietary quality. Given that individuals with prolonged SJL tend to delay their sleep and wake times, it is plausible that their food intake may also shift toward later hours. Future studies should investigate the timing of meals in relation to SJL, as evening and night-time eating have been associated with poorer diet quality and metabolic risk.

Conclusion

In conclusion, the study shows that SJL is significantly associated with increased energy intake and macronutrient consumption, particularly total fat, SFA, and CHOs, and increased fibre intake. However, no significant association was observed between SJL and UPF consumption after adjusting for confounders. These results suggest that circadian misalignment may contribute to reduced dietary quality independent of UPF consumption. The cross-sectional nature of the study indicates a need for further longitudinal and interventional research to clarify the causal pathways linking SJL with dietary behaviours and to explore the potential role of meal timing and chrononutrition strategies in reducing these effects.

Ethics

Ethics Committee Approval: The study was approved by the Ankara University Ethics Committee (approval no.: 06/53, date: 16.04.2024).

Informed Consent: After providing written informed consent, eligible individuals completed all assessments during a single visit under the supervision of trained research staff.

Footnotes

Authorship Contributions

Concept: M.B., E.N.S., G.D.A., Design: M.B., Data Collection or Processing: M.B., E.N.S., G.D.A., Analysis or Interpretation: M.B., Literature Search: M.B., E.N.S., G.D.A., Writing: M.B.

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Wittmann M, Dinich J, Merrow M, Roenneberg T. Social jetlag: misalignment of biological and social time. *Chronobiol Int.* 2006;23(1-2):497-509.
2. Roenneberg T, Allebrandt KV, Merrow M, Vetter C. Social jetlag and obesity. *Curr Biol*. 2012;22(10):939-943.
3. Castro N, Diana J, Blackwell J, Faulkner J, Lark S, Skidmore P, et al. Social jetlag and cardiometabolic risk in preadolescent children. *Front Cardiovasc Med.* 2021;8:705169.
4. Henderson SEM, Brady EM, Robertson N. Associations between social jetlag and mental health in young people: a systematic review. *Chronobiol Int.* 2019;36(10):1316-1333.
5. Parsons MJ, Moffitt TE, Gregory AM, Goldman-Mellor S, Nolan PM, Poulton R, et al. Social jetlag, obesity and metabolic disorder: investigation in a cohort study. *Int J Obes (Lond).* 2015;39:842-848.
6. Al Khatib H, Dikariyanto V, Bermingham KM, Gibson R, Hall WL. Short sleep and social jetlag are associated with higher intakes of non-milk extrinsic sugars, and social jetlag is associated with lower fibre intakes in those with adequate sleep duration: a cross-sectional analysis from the National Diet and Nutrition Survey Rolling Programme (Years 1-9). *Public Health Nutr.* 2022;25(9):2570-2581.
7. Bermingham KM, Stensrud S, Asnicar F, Valdes AM, Franks PW, Wolf J, et al. Exploring the relationship between social jetlag with gut microbial composition, diet and cardiometabolic health, in the ZOE PREDICT 1 cohort. *Eur J Nutr.* 2023;62(8):3135-3147.
8. Cetiner O, Yildirim G, Kalyoncu ZB. Social jetlag is associated with the frequency of consumption of sugar-sweetened beverages and a high BMI percentile in adolescents: results of the cross-sectional family life, activity, sun, health, and eating (FLASHE) study. *J Acad Nutr Diet.* 2021;121(9):1721-1731.e1.
9. Suikki T, Maukonen M, Partonen T, Jousilahti P, Kanerva N, Männistö S. Association between social jet lag, quality of diet and obesity by diurnal preference in Finnish adult population. *Chronobiol Int.* 2021;38(5):720-731.
10. Mota MC, Silva CM, Balieiro LCT, Gonçalves BF, Fahmy WM, Crispim CA. Association between social jetlag food consumption and meal times in patients with obesity-related chronic diseases. *PLoS One.* 2019;14(2):e0212126.
11. Mota MC, Waterhouse J, De-Souza DA, Rossato LT, Silva CM, Araujo MB, et al. Association between chronotype, food intake and physical activity in medical residents. *Chronobiol Int.* 2016;33(6):730-739.
12. Zerón-Rugerio MF, Cambras T, Izquierdo-Pulido M. Social jet lag associates negatively with the adherence to the mediterranean diet and body mass index among young adults. *Nutrients.* 2019;11(8):1756.
13. Bodur M, Baspinar B, Ozcelik AO. A cross-sectional evaluation of the relationship between social jetlag and diet quality. *Chronobiol Int.* 2021;38(11):1557-1568.
14. Bouman EJ, Beulens JWJ, Groeneveld L, de Kruijk RS, Schoonmade LJ, Remmelzwaal S, et al. The association between social jetlag and parameters of metabolic syndrome and type 2 diabetes: a systematic review and meta-analysis. *J Sleep Res.* 2023;32(3):e13770.
15. Calixto Andrade G, Julia C, Deschamps V, Srour B, Hercberg S, Kesse-Guyot E, et al. Consumption of ultra-processed food and its association with sociodemographic characteristics and diet quality in a representative sample of French adults. *Nutrients.* 2021;13(2):682.
16. Lin MY, Kang YN, Apriliyasari RW, Tsai PS. Association between social jetlag and components of metabolic syndrome: a systematic review and meta-analysis. *J Nurs Res.* 2024;32(5):e354.
17. Ciobanu D, Porojan M, Bala C, Zah AM, Oroian I, Roman G, et al. Lifestyle factors, dietary patterns, and social determinants of social and eating jetlag: a cross-sectional survey. *Chronobiol Int.* 2024;41(2):248-258.
18. Roenneberg T, Wirz-Justice A, Merrow M. Life between clocks: daily temporal patterns of human chronotypes. *J Biol Rhythms.* 2003;18(1):80-90.
19. Erdoğan Ş, Üçpunar HK, Tavat BC. Validity and reliability of the Turkish version of the Munich Chronotype Questionnaire. *Turk Psikiyatri Derg.* 2022;33(4):274-279.
20. Bouman EJ, Rutters F. The association between social jetlag and poor health and its (nutritional) mechanisms. *Public Health Nutr.* 2022;25(9):2582-2583.
21. Islam Z, Hu H, Akter S, Kuwahara K, Kochi T, Eguchi M, et al. Social jetlag is associated with an increased likelihood of having depressive symptoms among the Japanese working population: the Furukawa Nutrition and Health Study. *Sleep.* 2020;43(1):zsz204.
22. Rakıcıoğlu N TN, Ayaz A, Pekcan AG. Yemek ve besin fotoğraf kataloğu: ölçü ve miktarlar. Ankara: Ata Ofset Matbaacılık; 2010.

23. System BNI. Ebispro for Windows2022. p. Turkish Version.

24. Ülker İ, Çamli A. Ultra İşlenmiş Besin Tüketimi Hedonik Açlığı Etkiler Mi? *Journal of Nutrition and Dietetics*. 2024;52(1):68-76.

25. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F, et al. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr.* 2019;22(5):936-941.

26. Dicken SJ, Qamar S, Batterham RL. Who consumes ultra-processed food? A systematic review of sociodemographic determinants of ultra-processed food consumption from nationally representative samples. *Nutr Res Rev.* 2024;37(2):416-456.

27. Polsky JY, Jovovic S, Nardocci M, Moubarac JC. Socio-demographic correlates of ultra-processed food consumption in Canada. *Public Health Nutr.* 2024;27(1):e180.

28. Mattar JB, Domingos ALG, Hermsdorff HHM, Juvanhol LL, de Oliveira FLP, Pimenta AM, et al. Ultra-processed food consumption and dietary, lifestyle and social determinants: a path analysis in Brazilian graduates (CUME project). *Public Health Nutr.* 2022;25(12):1-9.

29. Moubarac JC, Batal M, Louzada ML, Martinez Steele E, Monteiro CA. Consumption of ultra-processed foods predicts diet quality in Canada. *Appetite.* 2017;108:512-520.

Appendix 1. List of Ultra-Processed Food Items

No	Ultra-processed food item
1	Packaged chips or crackers
2	Cookies
3	Cakes and cake mixes
4	Protein bar
5	Ice creams and frozen desserts
6	Chocolate bar
7	Breakfast cereals
8	Soft drinks
9	Sweetened juices
10	Powdered and other “instant” soups
11	Chocolate drinks
12	Tea-based drinks
13	Sweetened yoghurts
14	Burgers, hot dogs, sausages
15	Processed meat products
16	Packaged breads
17	Margarines and spreads
18	French fries
19	Mayonnaise, ketchup and mustard
20	Salad sauces
21	Noodles
22	Pizza