

Diet and Sleep

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2022-09-26

Background

This study seeks to assess the bi-directional association between the quality of one's sleep and different components of one's diet.

Data

Data from CM and DQ were combined for the purpose of this study. Two sets of data were collected, one for each direction of the analysis. In order to establish a temporal order, the event associated with the outcome variable was ensured to have occurred after the event associated with the predictor variable – for example, to assess the influence a subject's diet may have had on their sleep, the investigators recorded what they ate before they went to sleep.

For the purpose of this analysis, both datasets will be subsetting to just records that indicate the “Aligned” condition.

Variables

In investigating the influence that one's diet may have on their sleep, we are interested in the following predictors: energy, food weight (no beverages), energy density, protein, fat, carbohydrate, plant protein, animal protein, fiber, calcium, magnesium, sodium, zinc, vitamin B6, vitamin B12, saturated fat, unsaturated fat, vitamin D, fruits, vegetables, fruits and vegetables, eggs, nuts, dairy, and added sugar. We are interested in the following outcome variables that measure sleep: sleep efficiency, total sleep time, wake after sleep onset, and sleep fragmentation index.

In investigating the influence that one's sleep may have on their diet, we are interested in the following predictors: sleep efficiency, total sleep time, wake after sleep onset, and sleep fragmentation index. The following variables will serve as predictors: energy, food weight (no beverages), energy density, protein, fat, carbohydrate, plant protein, animal protein, fiber, calcium, magnesium, sodium, saturated fat, unsaturated fat, fruits, vegetables, fruits and vegetables, eggs, dairy, and added sugar.

In both analysis directions, we will also assess the significance of age, sex, and BMI as covariates

Methodology

We will construct linear mixed effect models to conduct a preliminary assessment of the relationships between all variables of interest. First, we will regress the outcome variable of interest on one predictor and the three covariates, adding a random intercept for subject ID. We will then evaluate the significance of the coefficients associated with each of the three covariates. If the coefficient is determined to not be significant (i.e., $p > 0.05$), it will be removed from the model. The truncated model will then be run again and its result saved.

Results

Diet and Sleep

The following table presents the results of regressing sleep outcome variables on diet predictors:

Outcome	Predictor	Model
SE	EN	$SE = 78.4283 + 0.337(AGE) + 6e-04(EN)$
TST	EN	$TST = 400.4625 + 0.0105(EN)$
WASO	EN	$WASO = 57.5766 - 0.8243(AGE) + 2e-04(EN)$
SFI	EN	$SFI = 18.6618 - 5e-04(EN)$
SE	FOOD_WT_F	$SE = 78.4128 + 0.3359(AGE) + 0.001(FOOD_WT_F)$
TST	FOOD_WT_F	$TST = 412.4507 + 0.0082(FOOD_WT_F)$
WASO	FOOD_WT_F	$WASO = 59.7262 - 0.806(AGE) - 0.002(FOOD_WT_F)$
SFI	FOOD_WT_F	$SFI = 19.1606 - 0.0013(FOOD_WT_F)$
SE	ED	$SE = 79.3072 + 0.3449(AGE) + 0.0408(ED)$
TST	ED	$TST = 406.8272 + 8.885(ED)$
WASO	ED	$WASO = 51.3111 - 0.7969(AGE) + 3.3597(ED)$
SFI	ED	$SFI = 16.7208 + 0.5234(ED)$
SE	PROT	$SE = 79.1502 + 0.3427(AGE) + 0.003(PROT)$
TST	PROT	$TST = 409.8319 + 0.1296(PROT)$
WASO	PROT	$WASO = 57.2403 - 0.8269(AGE) + 0.0078(PROT)$
SFI	PROT	$SFI = 17.9639 - 0.0035(PROT)$
SE	FAT	$SE = 78.6725 + 0.3408(AGE) + 0.01(FAT)$
TST	FAT	$TST = 399.0921 + 0.2807(FAT)$
WASO	FAT	$WASO = 56.1832 - 0.8307(AGE) + 0.0232(FAT)$
SFI	FAT	$SFI = 17.8005 - 0.0021(FAT)$
SE	CHO	$SE = 78.8497 + 0.3364(AGE) + 0.0033(CHO)$
TST	CHO	$TST = 404.2199 + 0.0773(CHO)$
WASO	CHO	$WASO = 58.5346 - 0.812(AGE) - 0.0042(CHO)$
SFI	CHO	$SFI = 19.934 - 0.0099(CHO)$
SE	PROT_PLANT	$SE = 79.3311 + 0.3449(AGE) + 0.0266(PROT_PLANT)$
TST	PROT_PLANT	$TST = 419.8634 + 1.4161(PROT_PLANT)$
WASO	PROT_PLANT	$WASO = 57.0201 - 0.816(AGE) + 0.3919(PROT_PLANT)$
SFI	PROT_PLANT	$SFI = 17.6176 + 0.0071(PROT_PLANT)$
SE	PROT_ANI	$SE = 79.1016 + 0.3378(AGE) + 0.0773(PROT_ANI)$
TST	PROT_ANI	$TST = 412.8371 + 1.5138(PROT_ANI)$
WASO	PROT_ANI	$WASO = 56.9568 - 0.8429(AGE) + 0.2389(PROT_ANI)$
SFI	PROT_ANI	$SFI = 17.4613 + 0.0274(PROT_ANI)$
SE	FIBER	$SE = 78.8933 + 0.3416(AGE) + 0.0281(FIBER)$
TST	FIBER	$TST = 416.6607 + 0.2692(FIBER)$
WASO	FIBER	$WASO = 58.477 - 0.8185(AGE) - 0.0353(FIBER)$
SFI	FIBER	$SFI = 18.9168 - 0.0625(FIBER)$
SE	CA	$SE = 78.7415 + 0.338(AGE) + 9e-04(CA)$
TST	CA	$TST = 406.4134 + 0.0166(CA)$
WASO	CA	$WASO = 58.2637 - 0.8181(AGE) - 6e-04(CA)$
SFI	CA	$SFI = 18.2895 - 7e-04(CA)$
SE	MG	$SE = 78.9172 + 0.3429(AGE) + 0.0016(MG)$
TST	MG	$TST = 415.0863 + 0.0216(MG)$
WASO	MG	$WASO = 58.773 - 0.8191(AGE) - 0.0031(MG)$
SFI	MG	$SFI = 18.4801 - 0.0026(MG)$
SE	NA	$SE = 78.2697 + 0.3358(AGE) + 4e-04(NA)$
TST	NA	$TST = 403.9238 + 0.0049(NA)$
WASO	NA	$WASO = 59.722 - 0.8079(AGE) - 6e-04(NA)$

Outcome	Predictor	Model
SFI	NA	$SFI = 18.4018 - 2e-04(NA)$
SE	ZN	$SE = 79.6486 + 0.3441(AGE) - 0.0214(ZN)$
TST	ZN	$TST = 412.0455 + 0.8703(ZN)$
WASO	ZN	$WASO = 56.4446 - 0.8198(AGE) + 0.1147(ZN)$
SFI	ZN	$SFI = 16.9419 + 0.0591(ZN)$
SE	VIT_B6	$SE = 78.7897 + 0.3438(AGE) + 0.2711(VIT_B6)$
TST	VIT_B6	$TST = 418.5736 + 1.5911(VIT_B6)$
WASO	VIT_B6	$WASO = 58.7901 - 0.8211(AGE) - 0.4241(VIT_B6)$
SFI	VIT_B6	$SFI = 18.0094 - 0.167(VIT_B6)$
SE	VIT_B12	$SE = 78.9422 + 0.35(AGE) + 0.058(VIT_B12)$
TST	VIT_B12	$TST = 418.601 + 0.7213(VIT_B12)$
WASO	VIT_B12	$WASO = 58.0411 - 0.8245(AGE) - 0.0249(VIT_B12)$
SFI	VIT_B12	$SFI = 12.3161 + 0.2206(BMI) - 0.1405(VIT_B12)$
SE	SFA	$SE = 79.1623 + 0.3429(AGE) + 0.0106(SFA)$
TST	SFA	$TST = 401.3029 + 0.8086(SFA)$
WASO	SFA	$WASO = 56.4365 - 0.8327(AGE) + 0.0662(SFA)$
SFI	SFA	$SFI = 17.5883 + 0.0016(SFA)$
SE	UFA	$SE = 78.4733 + 0.3406(AGE) + 0.0209(UFA)$
TST	UFA	$TST = 403.0031 + 0.3918(UFA)$
WASO	UFA	$WASO = 56.4203 - 0.8283(AGE) + 0.0327(UFA)$
SFI	UFA	$SFI = 17.9593 - 0.0067(UFA)$
SE	VIT_D	$SE = 79.1306 + 0.3466(AGE) + 0.0397(VIT_D)$
TST	VIT_D	$TST = 422.5331 - 0.061(VIT_D)$
WASO	VIT_D	$WASO = 57.5685 - 0.8199(AGE) + 0.0433(VIT_D)$
SFI	VIT_D	$SFI = 17.8103 - 0.0363(VIT_D)$
SE	FRUIT	$SE = 79.3893 + 0.3496(AGE) - 0.1188(FRUIT)$
TST	FRUIT	$TST = 419.7079 + 2.0589(FRUIT)$
WASO	FRUIT	$WASO = 57.8467 - 0.8274(AGE) + 0.1224(FRUIT)$
SFI	FRUIT	$SFI = 17.8413 - 0.1733(FRUIT)$
SE	VEG	$SE = 78.6162 + 0.3445(AGE) + 0.4413(VEG)$
TST	VEG	$TST = 423.512 - 0.7295(VEG)$
WASO	VEG	$WASO = 59.5408 - 0.8223(AGE) - 0.9615(VEG)$
SFI	VEG	$SFI = 18.7252 - 0.6282(VEG)$
SE	F_V	$SE = 79.0809 + 0.3371(AGE) + 0.1732(F_V)$
TST	F_V	$TST = 421.1741 + 0.3521(F_V)$
WASO	F_V	$WASO = 58.6194 - 0.8039(AGE) - 0.431(F_V)$
SFI	F_V	$SFI = 18.7216 - 0.3682(F_V)$
SE	EGG	$SE = 79.4855 + 0.3351(AGE) + 0.2721(EGG)$
TST	EGG	$TST = 423.1419 - 1.4822(EGG)$
WASO	EGG	$WASO = 57.9608 - 0.833(AGE) + 0.3128(EGG)$
SFI	EGG	$SFI = 17.3979 + 0.3764(EGG)$
SE	NUTS	$SE = 79.4534 + 0.3434(AGE) - 0.0414(NUTS)$
TST	NUTS	$TST = 420.3497 + 2.2528(NUTS)$
WASO	NUTS	$WASO = 57.2554 - 0.812(AGE) + 0.3699(NUTS)$
SFI	NUTS	$SFI = 17.5738 + 0.0664(NUTS)$
SE	DAIRY	$SE = 79.3834 + 0.3445(AGE) + 0.0024(DAIRY)$
TST	DAIRY	$TST = 413.9838 + 5.2428(DAIRY)$
WASO	DAIRY	$WASO = 57.9866 - 0.8213(AGE) - 0.1032(DAIRY)$
SFI	DAIRY	$SFI = 11.8914 + 0.2389(BMI) - 0.4511(DAIRY)$
SE	ADDED_SUGAR	$SE = 79.2821 + 0.3374(AGE) + 0.0368(ADDED_SUGAR)$
TST	ADDED_SUGAR	$TST = 407.9344 + 1.7064(ADDED_SUGAR)$
WASO	ADDED_SUGAR	$WASO = 57.1209 - 0.8707(AGE) + 0.2502(ADDED_SUGAR)$

Outcome	Predictor	Model
SFI	ADDED_SUGAR	$SFI = 17.1932 + 0.0522(ADDED_SUGAR)$

Sleep and Diet

The following table presents the results of regressing diet outcome variables on sleep predictors:

Outcome	Predictor	Model
EN	SE	$EN = 835.7312 + 13.7707(SE)$
FOOD_WT_F	SE	$FOOD_WT_F = 533.3701 + 7.3856(SE)$
ED	SE	$ED = 2.0464 - 0.0036(SE)$
PROT	SE	$PROT = 41.1426 - 17.0032(SEX2) + 0.6403(SE)$
FAT	SE	$FAT = - 9.5772 + 1.0185(SE)$
CHO	SE	$CHO = 145.4127 + 0.9855(SE)$
PROT_PLANT	SE	$PROT_PLANT = 1.1431 + 0.0055(SE)$
PROT_ANI	SE	$PROT_ANI = - 3.5518 + 0.3224(AGE) - 5.5952(SEX2) + 0.0177(SE)$
FIBER	SE	$FIBER = 14.8355 + 0.0664(SE)$
CA	SE	$CA = 187.9702 + 8.5724(SE)$
MG	SE	$MG = 315.4571 + 0.1555(SE)$
NA	SE	$NA = - 56.0175 + 41.5482(SE)$
SFA	SE	$SFA = - 11.4911 + 0.4165(SE)$
UFA	SE	$UFA = 0.1049 + 0.5401(SE)$
FRUIT	SE	$FRUIT = 0.8837 + 0.0039(SE)$
VEG	SE	$VEG = 1.6497 + 0.0011(SE)$
F_V	SE	$F_V = 2.8216 + 0.0017(SE)$
EGG	SE	$EGG = - 0.9321 + 0.0178(SE)$
DAIRY	SE	$DAIRY = - 3.3927 + 0.0668(BMI) + 0.0346(SE)$
ADDED_SUGAR	SE	$ADDED_SUGAR = - 5.7855 + 0.6804(BMI) - 0.0277(SE)$
EN	TST	$EN = 1259.6157 + 1.8906(TST)$
FOOD_WT_F	TST	$FOOD_WT_F = 897.7137 + 0.6901(TST)$
ED	TST	$ED = 1.6221 + 3e-04(TST)$
PROT	TST	$PROT = 50.5638 - 20.2203(SEX2) + 0.1136(TST)$
FAT	TST	$FAT = 28.9727 + 0.1228(TST)$
CHO	TST	$CHO = 192.5866 + 0.0955(TST)$
PROT_PLANT	TST	$PROT_PLANT = 0.3015 + 0.0031(TST)$
PROT_ANI	TST	$PROT_ANI = - 5.2275 + 0.3188(AGE) - 5.873(SEX2) + 0.008(TST)$
FIBER	TST	$FIBER = 18.0927 + 0.0063(TST)$
CA	TST	$CA = 674.6554 + 0.6504(TST)$
MG	TST	$MG = 252.2053 + 0.1822(TST)$
NA	TST	$NA = 2209.4126 + 3.3708(TST)$
SFA	TST	$SFA = 8.9714 + 0.0391(TST)$
UFA	TST	$UFA = 16.9984 + 0.0735(TST)$
FRUIT	TST	$FRUIT = 0.9925 + 6e-04(TST)$
VEG	TST	$VEG = 1.1478 + 0.0014(TST)$
F_V	TST	$F_V = 2.2298 + 0.0018(TST)$
EGG	TST	$EGG = 0.6549 - 0(TST)$
DAIRY	TST	$DAIRY = - 1.1372 + 0.0733(BMI) + 0.0016(TST)$
ADDED_SUGAR	TST	$ADDED_SUGAR = - 7.9079 + 0.6736(BMI) - 5e-04(TST)$
EN	WASO	$EN = 2059.1356 + 0.0063(WASO)$
FOOD_WT_F	WASO	$FOOD_WT_F = 1171.4421 + 0.5211(WASO)$
ED	WASO	$ED = 1.7644 - 0.001(WASO)$
PROT	WASO	$PROT = 91.2938 - 14.3651(SEX2) + 0.1803(WASO)$
FAT	WASO	$FAT = 83.3994 - 0.0702(WASO)$
CHO	WASO	$CHO = 234.5672 - 0.0458(WASO)$
PROT_PLANT	WASO	$PROT_PLANT = 1.539 + 0.0027(WASO)$
PROT_ANI	WASO	$PROT_ANI = - 3.2375 + 0.342(AGE) - 5.7335(SEX2) + 0.0211(WASO)$
FIBER	WASO	$FIBER = 21.7014 - 0.0277(WASO)$

Outcome	Predictor	Model
CA	WASO	$CA = 910.4148 + 1.1375(WASO)$
MG	WASO	$MG = 321.2085 + 0.2324(WASO)$
NA	WASO	$NA = 3709.1713 - 2.1186(WASO)$
SFA	WASO	$SFA = 27.3747 - 0.0531(WASO)$
UFA	WASO	$UFA = 48.537 - 0.0121(WASO)$
FRUIT	WASO	$FRUIT = 1.1521 + 0.0022(WASO)$
VEG	WASO	$VEG = 1.8875 - 0.004(WASO)$
F_V	WASO	$F_V = 3.0218 - 0.0013(WASO)$
EGG	WASO	$EGG = 0.7831 - 0.0038(WASO)$
DAIRY	WASO	$DAIRY = - 0.3788 + 0.0744(BMI) - 0.0027(WASO)$
ADDED_SUGAR	WASO	$ADDED_SUGAR = - 8.3616 + 0.6756(BMI) + 0.0059(WASO)$
EN	SFI	$EN = 2086.7981 - 1.5671(SFI)$
FOOD_WT_F	SFI	$FOOD_WT_F = 1163.9758 + 1.4609(SFI)$
ED	SFI	$ED = 1.7665 - 0.0021(SFI)$
PROT	SFI	$PROT = 99.1473 - 14.9557(SEX2) - 0.0844(SFI)$
FAT	SFI	$FAT = 83.0746 - 0.1204(SFI)$
CHO	SFI	$CHO = 238.0729 - 0.2915(SFI)$
PROT_PLANT	SFI	$PROT_PLANT = 1.47 + 0.0093(SFI)$
PROT_ANI	SFI	$PROT_ANI = - 2.2624 + 0.3265(AGE) - 5.5649(SEX2) + 0.0093(SFI)$
FIBER	SFI	$FIBER = 21.0189 - 0.0159(SFI)$
CA	SFI	$CA = 1003.9062 - 3.0779(SFI)$
MG	SFI	$MG = 349.2976 - 1.1439(SFI)$
NA	SFI	$NA = 3801.7291 - 9.4983(SFI)$
SFA	SFI	$SFA = 27.1119 - 0.09(SFI)$
UFA	SFI	$UFA = 48.1582 - 0.0024(SFI)$
FRUIT	SFI	$FRUIT = 1.1114 + 0.0067(SFI)$
VEG	SFI	$VEG = 2.0479 - 0.0171(SFI)$
F_V	SFI	$F_V = 3.1488 - 0.0099(SFI)$
EGG	SFI	$EGG = 0.8186 - 0.0095(SFI)$
DAIRY	SFI	$DAIRY = - 0.4719 + 0.0759(BMI) - 0.0021(SFI)$
ADDED_SUGAR	SFI	$ADDED_SUGAR = - 7.8399 + 0.6759(BMI) - 0.0193(SFI)$

GitHub Repository

All code for this report can be found in this Github repository.