Diet and Sleep

Waveley Qiu

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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 subsetted 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, corbohydrate, 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, corbohydrate, 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 (note: p-values and significance indications correspond to the coefficient for the predictor of interest):

Outcome	Predictor	Model	P-val	Sig?
SE	EN	SE = 78.4283 + 0.337(AGE) + 6e-04(EN)	0.194	
TST	EN	TST = 400.4625 + 0.0105(EN)	0.066	
WASO	EN	WASO = 57.5766 - 0.8243(AGE) + 2e-04(EN)	0.900	
SFI	EN	SFI = 18.6618 - 5e-04(EN)	0.449	
SE	FOOD_WT_F	SE = 78.4128 + 0.3359(AGE) + 0.001(FOOD_WT_F)	0.143	
TST	FOOD_WT_F	TST = 412.4507 + 0.0082(FOOD_WT_F)	0.367	
WASO	FOOD_WT_F	WASO = 59.7262 - 0.806(AGE) - 0.002(FOOD_WT_F)	0.341	
SFI	FOOD_WT_F	SFI = 19.1606 - 0.0013(FOOD_WT_F)	0.237	
SE	ED	SE = 79.3072 + 0.3449(AGE) + 0.0408(ED)	0.955	
TST	ED	TST = 406.8272 + 8.885(ED)	0.361	
WASO	ED	WASO = 51.3111 - 0.7969(AGE) + 3.3597(ED)	0.113	
SFI	ED	SFI = 16.7208 + 0.5234(ED)	0.628	
SE	PROT	SE = 79.1502 + 0.3427(AGE) + 0.003(PROT)	0.657	
TST	PROT	TST = 409.8319 + 0.1296(PROT)	0.152	
WASO	PROT	WASO = 57.2403 - 0.8269(AGE) + 0.0078(PROT)	0.698	
SFI	PROT	SFI = 17.9639 - 0.0035(PROT)	0.734	
SE	FAT	SE = 78.6725 + 0.3408(AGE) + 0.01(FAT)	0.243	
TST	FAT	TST = 399.0921 + 0.2807(FAT)	0.014	***
WASO	FAT	WASO = 56.1832 - 0.8307(AGE) + 0.0232(FAT)	0.354	
SFI	FAT	SFI = 17.8005 - 0.0021(FAT)	0.870	
SE	CHO	SE = 78.8497 + 0.3364(AGE) + 0.0033(CHO)	0.408	
TST	CHO	TST = 404.2199 + 0.0773(CHO)	0.133	
WASO	CHO	WASO = 58.5346 - 0.812(AGE) - 0.0042(CHO)	0.721	
SFI	CHO	SFI = 19.934 - 0.0099(CHO)	0.104	
SE	PROT_PLANT	SE = 79.3311 + 0.3449(AGE) + 0.0266(PROT_PLANT)	0.856	
TST	PROT_PLANT	TST = 419.8634 + 1.4161(PROT_PLANT)	0.476	
WASO	PROT_PLANT	WASO = 57.0201 - 0.816(AGE) + 0.3919(PROT_PLANT)	0.362	
SFI	PROT_PLANT	SFI = 17.6176 + 0.0071(PROT_PLANT)	0.974	
SE	PROT_ANI	SE = 79.1016 + 0.3378(AGE) + 0.0773(PROT_ANI)	0.304	
TST	PROT_ANI	TST = 412.8371 + 1.5138(PROT_ANI)	0.126	
WASO	PROT_ANI	WASO = 56.9568 - 0.8429(AGE) + 0.2389(PROT_ANI)	0.277	
SFI	PROT_ANI	SFI = 17.4613 + 0.0274(PROT_ANI)	0.810	
SE	FIBER	SE = 78.8933 + 0.3416(AGE) + 0.0281(FIBER)	0.401	
TST	FIBER	TST = 416.6607 + 0.2692(FIBER)	0.542	
WASO	FIBER	WASO = 58.477 - 0.8185(AGE) - 0.0353(FIBER)	0.718	
SFI	FIBER	SFI = 18.9168 - 0.0625(FIBER)	0.217	
SE	CA	SE = 78.7415 + 0.338(AGE) + 9e-04(CA)	0.196	
TST	CA	TST = 406.4134 + 0.0166(CA)	0.062	
WASO	CA	WASO = 58.2637 - 0.8181(AGE) - 6e-04(CA)	0.779	
SFI	CA	SFI = 18.2895 - 7e-04(CA)	0.497	
SE	MG	SE = 78.9172 + 0.3429(AGE) + 0.0016(MG)	0.455	
TST	MG	TST = 415.0863 + 0.0216(MG)	0.431	
WASO	MG	WASO = 58.773 - 0.8191(AGE) - 0.0031(MG)	0.618	
SFI	MG	SFI = 18.4801 - 0.0026(MG)	0.421	
SE	NA	SE = 78.2697 + 0.3358(AGE) + 4e-04(NA)	0.101	
TST	NA	TST = 403.9238 + 0.0049(NA)	0.093	
WASO	NA	WASO = 59.722 - 0.8079(AGE) - 6e-04(NA)	0.354	
SFI	NA	SFI = 18.4018 - 2e-04(NA)	0.549	
SE	ZN	SE = 79.6486 + 0.3441(AGE) - 0.0214(ZN)	0.664	

Outcome	Predictor	Model	P-val	Sig?
TST	ZN	TST = 412.0455 + 0.8703(ZN)	0.193	
WASO	ZN	WASO = 56.4446 - 0.8198(AGE) + 0.1147(ZN)	0.427	
SFI	ZN	SFI = 16.9419 + 0.0591(ZN)	0.415	
SE	VIT_B6	SE = 78.7897 + 0.3438(AGE) + 0.2711(VIT_B6)	0.212	
TST	VIT_B6	TST = 418.5736 + 1.5911(VIT_B6)	0.585	
WASO	VIT_B6	WASO = 58.7901 - 0.8211(AGE) - 0.4241(VIT_B6)	0.506	
SFI	VIT_B6	SFI = 18.0094 - 0.167(VIT_B6)	0.608	
SE	VIT_B12	SE = 78.9422 + 0.35(AGE) + 0.058(VIT_B12)	0.377	
TST	VIT_B12	TST = 418.601 + 0.7213(VIT_B12)	0.416	
WASO	VIT_B12	WASO = 58.0411 - 0.8245(AGE) - 0.0249(VIT_B12)	0.897	
SFI	VIT_B12	SFI = 12.3161 + 0.2206(BMI) - 0.1405(VIT_B12)	0.359	
SE	SFA	SE = 79.1623 + 0.3429(AGE) + 0.0106(SFA)	0.645	
TST	SFA	TST = 401.3029 + 0.8086(SFA)	0.009	***
WASO	SFA	WASO = 56.4365 - 0.8327(AGE) + 0.0662(SFA)	0.325	
SFI	SFA	SFI = 17.5883 + 0.0016(SFA)	0.962	
SE	UFA	SE = 78.4733 + 0.3406(AGE) + 0.0209(UFA)	0.131	
TST	UFA	TST = 403.0031 + 0.3918(UFA)	0.034	***
WASO	UFA	WASO = 56.4203 - 0.8283(AGE) + 0.0327(UFA)	0.422	
SFI	UFA	SFI = 17.9593 - 0.0067(UFA)	0.745	
SE	VIT_D	SE = 79.1306 + 0.3466(AGE) + 0.0397(VIT_D)	0.468	
TST	VIT_D	TST = 422.5331 - 0.061(VIT_D)	0.935	
WASO	VIT_D	WASO = 57.5685 - 0.8199(AGE) + 0.0433(VIT_D)	0.788	
SFI	VIT_D	SFI = 17.8103 - 0.0363(VIT_D)	0.650	
SE	FRUIT	SE = 79.3893 + 0.3496(AGE) - 0.1188(FRUIT)	0.687	
TST	FRUIT	TST = 419.7079 + 2.0589(FRUIT)	0.599	
WASO	FRUIT	WASO = 57.8467 - 0.8274(AGE) + 0.1224(FRUIT)	0.887	
SFI	FRUIT	SFI = 17.8413 - 0.1733(FRUIT)	0.691	
SE	VEG	SE = 78.6162 + 0.3445(AGE) + 0.4413(VEG)	0.070	
TST	VEG	TST = 423.512 - 0.7295(VEG)	0.823	
WASO	VEG	WASO = 59.5408 - 0.8223(AGE) - 0.9615(VEG)	0.178	
SFI	VEG	SFI = 18.7252 - 0.6282(VEG)	0.089	
SE	F_V	SE = 79.0809 + 0.3371(AGE) + 0.1732(F_V)	0.313	
TST	F_V	TST = 421.1741 + 0.3521(F_V)	0.877	
WASO	F_V	WASO = 58.6194 - 0.8039(AGE) - 0.431(F_V)	0.391	
SFI	F_V	SFI = 18.7216 - 0.3682(F_V)	0.154	
SE	EGG	SE = 79.4855 + 0.3351(AGE) + 0.2721(EGG)	0.443	
TST	EGG	TST = 423.1419 - 1.4822(EGG)	0.755	
WASO	EGG	WASO = 57.9608 - 0.833(AGE) + 0.3128(EGG)	0.764	
SFI	EGG	SFI = 17.3979 + 0.3764(EGG)	0.471	
SE	NUTS	SE = 79.4534 + 0.3434(AGE) - 0.0414(NUTS)	0.836	
TST	NUTS	TST = 420.3497 + 2.2528(NUTS)	0.400	
WASO	NUTS	WASO = 57.2554 - 0.812(AGE) + 0.3699(NUTS)	0.528	
SFI	NUTS	SFI = 17.5738 + 0.0664(NUTS)	0.824	
SE	DAIRY	SE = 79.3834 + 0.3445(AGE) + 0.0024(DAIRY)	0.992	
TST	DAIRY	TST = 413.9838 + 5.2428(DAIRY)	0.099	
WASO	DAIRY	WASO = 57.9866 - 0.8213(AGE) - 0.1032(DAIRY)	0.884	
SFI	DAIRY	SFI = 11.8914 + 0.2389(BMI) - 0.4511(DAIRY)	0.366	
SE	ADDED_SUGAR	SE = 79.2821 + 0.3374(AGE) + 0.0368(ADDED_SUGAR)	0.497	
TST	ADDED_SUGAR	TST = 407.9344 + 1.7064(ADDED_SUGAR)	0.013	***
WASO	ADDED_SUGAR	WASO = 57.1209 - 0.8707(AGE) + 0.2502(ADDED_SUGAR)	0.112	
SFI	ADDED_SUGAR	SFI = 17.1932 + 0.0522(ADDED_SUGAR)	0.527	

Sleep and Diet

The following table presents the results of regressing diet outcome variables on sleep predictors (note: p-values and significance indications correspond to the coefficient for the predictor of interest):

Outcome	Predictor	Model	P-val	Sig?
EN	SE	EN = 835.7312 + 13.7707(SE)	0.188	
FOOD_WT_F	SE	FOOD_WT_F = 533.3701 + 7.3856(SE)	0.251	
ED	SE	ED = 2.0464 - 0.0036(SE)	0.598	
PROT	SE	PROT = 41.1426 - 17.0032(SEX2) + 0.6403(SE)	0.347	
FAT	SE	FAT = - 9.5772 + 1.0185(SE)	0.054	
CHO	SE	CHO = 145.4127 + 0.9855(SE)	0.377	
PROT_PLANT	SE	PROT_PLANT = 1.1431 + 0.0055(SE)	0.853	
PROT_ANI	SE	PROT_ANI = - 3.5518 + 0.3224(AGE) - 5.5952(SEX2) + 0.0177(SE)	0.767	
FIBER	SE	FIBER = 14.8355 + 0.0664(SE)	0.620	
CA	SE	CA = 187.9702 + 8.5724(SE)	0.206	
MG	SE	MG = 315.4571 + 0.1555(SE)	0.942	
NA	SE	NA = - 56.0175 + 41.5482(SE)	0.037	***
SFA	SE	SFA = - 11.4911 + 0.4165(SE)	0.032	***
UFA	SE	UFA = 0.1049 + 0.5401(SE)	0.093	
FRUIT	SE	FRUIT = 0.8837 + 0.0039(SE)	0.801	
VEG	SE	VEG = 1.6497 + 0.0011(SE)	0.953	
F_V	SE	F_V = 2.8216 + 0.0017(SE)	0.947	
EGG	SE	EGG = - 0.9321 + 0.0178(SE)	0.162	
DAIRY	SE	DAIRY = - 3.3927 + 0.0668(BMI) + 0.0346(SE)	0.045	***
ADDED_SUGAR	SE	ADDED_SUGAR = - 5.7855 + 0.6804(BMI) - 0.0277(SE)	0.787	
EN	TST	EN = 1259.6157 + 1.8906(TST)	0.012	***
FOOD_WT_F	TST	FOOD_WT_F = 897.7137 + 0.6901(TST)	0.133	
ED	TST	ED = 1.6221 + 3e-04(TST)	0.606	
PROT	TST	PROT = 50.5638 - 20.2203(SEX2) + 0.1136(TST)	0.021	***
FAT	TST	FAT = 28.9727 + 0.1228(TST)	0.001	***
CHO	TST	CHO = 192.5866 + 0.0955(TST)	0.231	
PROT_PLANT	TST	PROT_PLANT = 0.3015 + 0.0031(TST)	0.147	
PROT_ANI	TST	PROT_ANI = - 5.2275 + 0.3188(AGE) - 5.873(SEX2) + 0.008(TST)	0.061	
FIBER	TST	FIBER = 18.0927 + 0.0063(TST)	0.515	
CA	TST	CA = 674.6554 + 0.6504(TST)	0.186	
MG	TST	MG = 252.2053 + 0.1822(TST)	0.229	
NA	TST	NA = 2209.4126 + 3.3708(TST)	0.018	***
SFA	TST	SFA = 8.9714 + 0.0391(TST)	0.007	***
UFA	TST	UFA = 16.9984 + 0.0735(TST)	0.002	***
FRUIT	TST	FRUIT = 0.9925 + 6e-04(TST)	0.618	
VEG	TST	VEG = 1.1478 + 0.0014(TST)	0.296	
F_V	TST	F_V = 2.2298 + 0.0018(TST)	0.353	
EGG	TST	EGG = 0.6549 - 0(TST)	0.996	
DAIRY	TST	DAIRY = - 1.1372 + 0.0733(BMI) + 0.0016(TST)	0.139	
ADDED_SUGAR	TST	ADDED_SUGAR = - 7.9079 + 0.6736(BMI) - 5e-04(TST)	0.937	
EN	WASO	EN = 2059.1356 + 0.0063(WASO)	0.998	
FOOD_WT_F	WASO	FOOD_WT_F = 1171.4421 + 0.5211(WASO)	0.798	
ED	WASO	ED = 1.7644 - 0.001(WASO)	0.646	
PROT	WASO	PROT = 91.2938 - 14.3651(SEX2) + 0.1803(WASO)	0.402	
FAT	WASO	FAT = 83.3994 - 0.0702(WASO)	0.681	
CHO	WASO	CHO = 234.5672 - 0.0458(WASO)	0.897	
PROT_PLANT	WASO	PROT_PLANT = 1.539 + 0.0027(WASO)	0.777	
PROT_ANI	WASO	PROT_ANI = - 3.2375 + 0.342(AGE) - 5.7335(SEX2) + 0.0211(WASO)	0.264	
FIBER	WASO	FIBER = 21.7014 - 0.0277(WASO)	0.514	
CA	WASO	CA = 910.4148 + 1.1375(WASO)	0.599	

Outcome	Predictor	Model	P-val	Sig?
MG	WASO	MG = 321.2085 + 0.2324(WASO)	0.729	
NA	WASO	NA = 3709.1713 - 2.1186(WASO)	0.738	
SFA	WASO	SFA = 27.3747 - 0.0531(WASO)	0.406	
UFA	WASO	UFA = 48.537 - 0.0121(WASO)	0.907	
FRUIT	WASO	FRUIT = 1.1521 + 0.0022(WASO)	0.651	
VEG	WASO	VEG = 1.8875 - 0.004(WASO)	0.504	
F_V	WASO	F_V = 3.0218 - 0.0013(WASO)	0.872	
EGG	WASO	EGG = 0.7831 - 0.0038(WASO)	0.358	
DAIRY	WASO	DAIRY = - 0.3788 + 0.0744(BMI) - 0.0027(WASO)	0.551	
ADDED_SUGAR	WASO	ADDED_SUGAR = - 8.3616 + 0.6756(BMI) + 0.0059(WASO)	0.823	
EN	SFI	EN = 2086.7981 - 1.5671(SFI)	0.813	
FOOD_WT_F	SFI	FOOD_WT_F = 1163.9758 + 1.4609(SFI)	0.718	
ED	SFI	ED = 1.7665 - 0.0021(SFI)	0.626	
PROT	SFI	PROT = 99.1473 - 14.9557(SEX2) - 0.0844(SFI)	0.844	
FAT	SFI	FAT = 83.0746 - 0.1204(SFI)	0.722	
CHO	SFI	CHO = 238.0729 - 0.2915(SFI)	0.677	
PROT_PLANT	SFI	PROT_PLANT = 1.47 + 0.0093(SFI)	0.624	
PROT_ANI	SFI	PROT_ANI = - 2.2624 + 0.3265(AGE) - 5.5649(SEX2) + 0.0093(SFI)	0.803	
FIBER	SFI	FIBER = 21.0189 - 0.0159(SFI)	0.850	
CA	SFI	CA = 1003.9062 - 3.0779(SFI)	0.474	
MG	SFI	MG = 349.2976 - 1.1439(SFI)	0.390	
NA	SFI	NA = 3801.7291 - 9.4983(SFI)	0.450	
SFA	SFI	SFA = 27.1119 - 0.09(SFI)	0.477	
UFA	SFI	UFA = 48.1582 - 0.0024(SFI)	0.991	
FRUIT	SFI	FRUIT = 1.1114 + 0.0067(SFI)	0.491	
VEG	SFI	VEG = 2.0479 - 0.0171(SFI)	0.150	
F_V	SFI	F_V = 3.1488 - 0.0099(SFI)	0.550	
EGG	SFI	EGG = 0.8186 - 0.0095(SFI)	0.243	
DAIRY	SFI	DAIRY = - 0.4719 + 0.0759(BMI) - 0.0021(SFI)	0.813	
ADDED_SUGAR	SFI	ADDED_SUGAR = - 7.8399 + 0.6759(BMI) - 0.0193(SFI)	0.712	

GitHub Repository

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