The Influence of Sleep Practices, Chronotype, and Life-Style Variables on Sleep Quality among Students at Rusangu University, Zambia

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Universally, students develop poor sleep habits in attempts to meet various demands. The variation in sleep quality may be related to both cultural and academic variables. This study examined the influence of sleeping practices, chronotype, demographics and selected life-style variables on students' sleep quality at Rusangu University, Zambia. A cross-section of Rusangu University students (n=212) reported about their demographics, sleep practices, chronotype, and sleep quality as measured by the Pittsburg Sleep Quality Index. Most of the students (79.2%) had poor sleep. The correlation between sleep hygiene and sleep quality were negligible (r=.01 to r=.17). Evening-types (M=1.52, SD=0.69) had significantly higher sleep disturbances than morning-types (M=1.11, SD=0.58) or neither-morning-or-evening-types (M=1.20, SD=0.56). There were no gender differences on the linear combination of sleep quality indices. Neither were there differences in sleep quality across the year of study. Sleep quality was also unrelated to sleep pattern.

Keywords: Students, Sleep Practices, Chronotype, Lifestyle, Sleep Quality.

1 Introduction

The ever-rising emphasis on education around the world has brought about the emergence of more people matriculating into higher education. Having its own standards of requirements, academia places on students a rather straining need to keep up. Adjusting to academia has taken a toll on the students' general well-being including sleep. Researches (Schwarz et al, 2013; Carney et al, 2006; Al-Kandari et al, 2017; Lukowski and Milojevich, 2013) indicate that students across the globe fall prey to sleep behaviour maladjustment including poor sleep patterns and practices as a result to rising demands socially as well as in academics. Other studies (Mander et al, 2011; Gilbert and Weaver, 2010; Pilcher and Walters, 2010) have gone further to establish the relationship between sleep practices and academic achievement. Different cultures, countries and academic orientations bring to the table varying statistics pertaining to sleep practices. Seeing that poor sleep quality comes along with measurable shortcomings from a molecular level to cognitive functions, it is imperative that each institution have a sleep profile so as to have contextualized, evidence-based psycho-educational programs on sleep as a cost-effective way to alleviate current, and/or prevent future rise of the effects thereof.

Given the absence of information on sleep practices among universities students in Zambia, we carried out the present study with a view to undertake an evidence-based awareness on health and wellbeing campaign for university students in Zambia. A sleep profile of

Rusangu University students was set as baseline for this exercise. Thus, the aim of the present study was to establish how sleeping practices, chronotype and life-style variables influence sleep quality among Rusangu university students. Specifically, what is the sleep quality of students at Rusangu University? To what extent is sleep quality related to sleep hygiene, sleeping practices and lifestyle variables?

2 Methods

A cross section of full-time students at Rusangu University in Zambia attempted the survey. A stratified random sampling was employed for age, gender, marital status, School, year of study, and accommodation. The study proposal and instrument were reviewed and approval by the university ethics board to assure compliance with international ethics guidelines.

The research data was collected using a self-reported pretested questionnaire that included four sections. The first section were closed-ended questions which covered demographic characteristics (age, gender, marital status, School, year of study, and accommodation), selected lifestyle variables (work engagement, exercise, consumption of caffeine and alcohol, smoking, taking psychostimulants, media time, study schedule), sleep behaviors (sleep disorder, bedtime, rise up time, sleep pattern).

The second section collected data on sleep quality by a standardized test, the Pittsburgh Sleep Quality Index (PSQI). The third section was on sleep hygiene practices where participants had to either agree or disagree to practicing. Finally, the last section was assessing chronotype with the aid of the Reduced Morningness–Eveningness Questionnaire (rMEQ), a standardized test.

For scoring purposes, the data were entered, edited, and analyzed using the SPSS version 25 for Windows (SPSS Inc., Chicago, IL, USA). To establish demographic characteristics of the sample as well as the prevalence of selected lifestyle variables, chronotype, sleep hygiene practices, descriptive statistics were used. Standard scoring was used on the MEQ, and subjects were categorized into morning, neither, or evening types. Subjects who scored as moderately morning or evening were included in the morning and evening groups, respectively. A PSQI global score above 5 was used to categorize poor sleep, and sleep duration <6.5 hours was categorized as insufficient sleep.

3 Results

3.1 Participants

The participants included 212 university students from Rusangu University in Monze district in Zambia. Male and female respondents were equal in number at 50% each. A majority (78.8%) were between the ages of 18-24 years, while 3.3% were below 18 years and 17.9% were above 24 years. Almost all (92.5%) were single. Most were from the Faculty of Health Sciences (44.3%) followed by those from the Faculty of Education (13.7%). The remaining

respondents were from the Faculties of Business (12.7%), Humanities (11.3%), natural sciences (11.8%) and Theory (6.1%). Respondents by year of study were fairly even at 23.1% for 1st year students to 19.8% for 4th year students. Most (78.8%) lived in university hostels.

3.2 Sleep Quality

Sleep quality as measured by the Pittsburg Sleep Quality Index (PSQI) are reported in Table 1. Approximately 79% rated their sleep quality as fairly good to very good. About 65% reported taking between 1-4 hours to being fully awake to sleeping (Sleep latency). Forty-three percent reported sleeping 6 or more hours while 60.4% reported sleep efficiency (ratio of total sleep time to time in bed) at 85% or better; and one-fourth (26%) said they have problems initiating and maintain sleep (sleep disturbances) 1 or more time a week. Most (90.6%) do not take sleep medication; 60.9% rated daytime dysfunction at 'slight to somewhat of a problem'. Based on self-ratings of the 7 components of the PSQI, 79.2% of the students in this study were classified as having 'poor' sleep.

3.3 Lifestyle variables, sleep behavior patterns, and sleep hygiene practices

Descriptive statistics of personal lifestyle habits, sleep behavior patterns, and sleep hygiene practices are reported in Tables 2, 3, and 4 respectively. On personal lifestyle habits, Table 2 indicates most do not work (74.5%); never smoke (94/3%), drink alcohol (86.8%), use psychostimulants (89.6) or use mediation/supplements (90.1%). However, about 75% use caffeine one or more times a week. Student sleep behavior patterns are summarized on Table 3. Most (97.6%) reported no sleep disorder. Approximately 86%) said they stop using electronic devices (phone, computer) between 2100 and 0300. A majority (90.5%) sleep between 2100 and 0300 and 91.1% reported waking up between 0300 and 0900 during weekdays. Personal study time were between 1800 and 2400 for most (74.1%) of the students. Sleep pattern was monophasic for 52.6% of the students. About 41% were classified as biphasic. Sleep hygience practices are summarized on Table 4. Most students (66.5%) take naps occasionally during the day; never thirsty or hungry at bedtime (68.4%); sleep on comfortable bedroom (52.4%); and do not smoke (96.2%) or eat heavy meals (59.9%) near bedtime. Participants classified themselves as morning type (35.4%), evening type (13.7%) or neither (50.9%); that is, these are times when they reported themselves as most alert and energetic.

Table 1. Pittsburgh Sleep Quality Index (PSQI) of the Study Participants

PSQI Component	Categories	f	%
1. Subjective Sleep Quality	Very good	39	18.4
	Fairly good	129	60.8
	Fairly bad	35	16.5
	Very bad	9	4.2
2. Sleep Latency	(0) 0	48	22.6
	(1) 1-2	76	35.8

	(2) 3-4	62	29.2
	(3) 5-6	26	12.3
3. Sleep Duration	> 7 hours	36	17.0
	6-7 hours	55	25.9
	5-6 hours	91	42.9
	<5 hours	30	14.2
4. Sleep Efficiency	>85%	128	60.4
	75 – 84%	53	25.0
	65 - 74%	16	7.5
	<65%	15	7.1
5. Sleep Disturbance	(0) 0	15	7.1
	(1) 1-9	142	67.0
	(2) 10-18	50	23.6
	(3) 19-27	4	1.9
	(4) 28	1	0.5
6. Use of Sleep Medication	Not in the last month	192	90.6
	Less than once a week	11	5.2
	Once or twice a week	6	2.8
	3 or more times a week	3	1.4
7. Daytime dysfunction	(0) 0	72	34.0
	(1) 1-2	96	45.3
	(2) 3-4	33	15.6
	(3) 5-6	11	5.2
PSQI Global Score	Good Sleep (<5)	44	20.8
	Poor Sleep (5 <=)	168	79.2
TOTAL		**212**	**100**

Table 2. Lifestyle variables

Lifestyle	Categories	f	%
Work engagement	None	158	74.5
	1 hour/day	22	10.4
	2 hours/day	7	3.3
	3 hours/day	7	3.3
	4 hours/day	5	2.4
	5-7hours/day	8	3.8
	8 and above/day	5	2.4
Caffeine	Never	55	25.9
	Once/week	60	28.3
	2-3 times/week	46	21.7
	4-6 times/week	22	10.4
	Daily	29	13.7
Alcohol	Never	184	86.8
	Once/week	23	10.8
	2-3times/week	2	.9
	4-6 times/week	2	.9
	Daily	1	.5

Smoke	Never	200	94.3
	Once	3	1.4
	2-3 times/week	4	1.9
	4-6times/week	5	2.5
Psychostimulants	Never	190	89.6
	Once in my life	8	3.8
	few times in my life	7	3.3
	few times a year	2	.9
	once or twice a month	1	.5
	at least once a week	3	1.4
	take them most days	1	.5
Night outing	Never	153	72.2
	Once	49	23.1
	2-3 times/week	9	4.2
	4-6 times/week	1	.5
Medication/Supplements	Yes	21	9.9
	No	191	90.1
TOTAL		**212**	**100**

Table 3. Sleep behavior patterns

Behaviors	**Categories**	**F**	**%**
Sleep Disorder	Yes	5	2.4
	No	207	97.6
Stop using phone/Computer	Between 18:00 and 20.59	10	4.7
	Between 21:00 and 23.59	124	58.5
	Between 24:00 and 03:00	58	27.4
	Use it throughout the night	9	4.2
	None of the above	11	5.2
Bedtime during the week	Between 18:00 and 20.59	12	5.7
	Between 21:00 and 23.59	115	54.2
	Between 24:00 and 2:59	77	36.3
	Between 3:00 and 5:59	8	3.8
Bedtime during the week-end	Before 18:00	2	0.9
	Between 18:00 and 20.59	16	7.5
	Between 21:00 and 23.59	116	54.7
	Between 24:00 and 2:59	63	29.7
	Between 3:00 and 06:00	12	5.7
	After 06:00	3	1.4
Waking up time during the week	Between Before 24:00	3	1.4
	Between 24:00 - 02:59	4	1.9
	Between 03:00 – 05:59	83	39.2
	Between 06:00 – 08:59	110	51.9
	Between 09:00 – 11:59	12	5.7
Waking up time during the weekend	Before 24:00	5	2.4
	Between 24:00 - 02:59	3	1.4
	Between 03:00 – 05:59	31	14.6
	Between 06:00 – 08:59	120	56.6

	Between 09:00 – 11:59	47	22.2
	After 12:00	6	2.8
Personal study schedule	Between 18:00 – 20.59	18	8.5
	Between 18:00 -23.59	63	29.7
	Between 18:00 – 02.59	21	9.9
	Between 21:00 – 24:00	55	25.9
	Between 24:00 – 2:59	46	21.7
	Between 03:00 – 06:00	9	4.2
Timing of the First class of the day	Before 05:00	5	2.4
	Between 05:00 – 6:59	14	6.6
	Between 07:00 – 08:59	141	66.5
	Between 09:00 – 12:00	46	21.7
	After 12:00	6	2.8
Timing of the Last class of the day	Before 12:00	28	13.2
	Between 12:00 – 14:59	73	34.4
	Between 15:00 – 17:59	79	37.3
	Between 18:00 – 20:59	24	11.3
	After 21:00	8	3.8
Sleep Pattern	Monophasic	111	52.4
	Biphasic	86	40.6
	Polyphasic	15	7.1
TOTAL		**212**	**100**

Table 4. Sleep hygiene practices (n=212)

Sleep Hygiene practices	Categories	f	%
1.Take a nap during the day occasionally	Yes	141	66.5
	No	71	33.5
2.Smoke within 2 hours before bed	Yes	8	3.8
	No	204	96.2
3. Eat heavy night meals near bedtime	Yes	85	40.1
	No	127	59.9
4. Perform dynamic physical activities within 2 hours before sleep	Yes	55	25.9
	No	157	74.1
5. Go to bed thirsty or hungry	Yes	67	31.6
	No	145	68.4
6. Think about day's events and worry at bed	Yes	175	82.5
	No	37	17.5
7. Engage in highly demanding activities near bedtime like watching an exciting movie	Yes	130	61.3
	No	82	38.7
8. Use bed for activities other than sleeping	Yes	115	54.2
	No	97	45.8
9. Sleep in uncomfortable bedroom i.e temperature, light, noise	Yes	101	47.6
	No	111	52.4

10. Sleep and wake at different times during the week	Yes	144	67.9
	No	68	32.1
TOTAL		**212**	**100**

3.4 Sleeping practices (hygiene), sleep pattern and sleep quality

Bivariate correlation coefficients (Spearman rho) between sleep hygiene and sleep quality are reported on Table 5. Coefficients of .14 or higher are statistically significant at the .05 level. Significant correlations are between taking naps and sleep efficiency (r=.14); smoking before bedtime and sleep disturbances (r=-.16); eating heavy meals before bedtime and use of sleep medication (r=-.16); physical activities before bedtime and use of sleep medication (r=-.17); going to bed thirsty or hungry and sleep duration (r=-.14); uncomfortable bedroom and use of sleep medication (r= -.15); and irregular sleep pattern during the week and subjective sleep quality (r= -.16). There appears to be some correlation between certain sleep hygiene practices and sleep quality. However, these relationships are quite negligible and given the number of correlation coefficients, it is likely that these significant correlations may be due to inflation of Type I error.

We report the bivariate correlation coefficients (Spearman rho) between sleep behavior patterns and sleep quality on Table 6. There are significant correlations between some sleep behavior patterns and sleep quality components. Significant correlations (α=.05) range from a low of .137 between time when stopping e-devices and sleep efficiency to only a high of .209 between time when stopping e-devices and sleep disturbances. These significant correlations are quite negligible and suggests that there is little/negligible correlation between sleep quality and sleep behavior patterns. Spearman rho correlation between lifestyle variables and sleep quality are reported on Table 7. Correlation between use of psychoactive substances and sleep disturbances is .158 (p<.05) while the correlation between smoking and sleep duration is .150 (p<.05). However, these coefficients are quite negligible suggesting that sleep quality may not be related to lifestyle variables.

Table 5. Correlation coefficients (Spearman rho) between sleep hygiene and sleep quality.

Sleep Hygiene	SSQ	SL	SD	SE	SDi	USM	DDys	Total
Take a naps	.06	-.03	.08	**.14**	.03	-.05	.05	.11
Smoke before bedtime.	.01	-.07	-.09	-.03	**-.16***	-.02	-.08	-.12
Eat heavy meals near bedtime.	-.05	-.01	-.05	.07	-.05	**-.16***	-.11	-.07
Physical activities before asleep.	-.04	-.07	-.11	-.05	.03	**-.17***	-.01	-.09
Go to bed thirsty or hungry.	-.09	-.13	**-.14**	-.04	.04	-.12	.02	-.12
Think and worry about day's events.	-.12	-.04	-.05	-.05	-.04	-.02	-.11	-.12
Highly demanded activities	-.01	.01	-.11	-.03	-.06	-.06	-.10	-.11

Use bed for activities other than sleep.	.03	.07	-.13	-.04	-.01	.06	-.06	-.01
Sleep in uncomfortable bedroom	-.01	-.13	.06	-.02	-.06	**-.15***	.02	-.06
Sleep and wake at the different time during the week.	**-.16***	-.07	.01	.01	-.09	.01	-.03	-.10

**p<.05; SSQ - Subjective sleep quality; SL- Sleep latency; SD – Sleep duration; SE – Sleep efficiency; SDi – Sleep disturbances; USM – Use of sleep medication; DDys – Daytime dysfunction; Total – PSQI total score*

Table 6. Relationships between sleep behaviour patterns and sleep quality.

Sleep behaviour patterns	SSQ	SL	SD	SE	SDi	USM	DDys	Total
Time stop using a computer or phone?	-.009	.079	**.218****	**.137***	**.209****	-.040	.108	**.170***
Time go to sleep weekdays	.082	.056	**.147***	.073	.078	.023	.096	.108
Time go to sleep weekends	.076	**.170***	**.161***	**.150***	**.142***	.044	.079	**.158***
Time wake up weekdays	-.078	.040	**-.172***	.107	-.064	-.016	.052	-.045
Time wake up weekends	-.036	.108	-.113	.009	**.140***	**.166***	.106	.058
Night time personal study schedule	-.005	-.030	.129	.004	.034	.095	-.092	-.065

**p<.05; SSQ - Subjective sleep quality; SL- Sleep latency; SD – Sleep duration; SE – Sleep efficiency; SDi – Sleep disturbances; USM – Use of sleep medication; DDys – Daytime dysfunction; Total – PSQI total score.*

Table 7. Relationships between lifestyle variables and sleep quality.

Life Style	SSQ	SL	SD	SE	SDi	USM	DDys	Total
Engaging in exercise	-.040	.000	-.001	-.025	.000	.045	-.025	-.053
consume caffeinated beverages	-.020	.085	-.042	.016	.083	-.010	.117	-.023
consume alcohol	.007	.042	.124	.113	-.058	.094	.010	.059
smoke	.040	.073	**.150***	.059	.081	-.016	-.010	.095
use psychoactive substances	.063	.058	.109	.091	**.158***	-.020	.129	.118
go for social night outings	-.030	**.138***	**.149***	.100	.002	.101	.074	.051
On medication or supplements	-.036	.025	.057	-.090	-.067	-.056	-.051	.025

**p<.05; SSQ - Subjective sleep quality; SL- Sleep latency; SD – Sleep duration; SE – Sleep efficiency; SDi – Sleep disturbances; USM – Use of sleep medication; DDys – Daytime dysfunction; Total – PSQI total score*

3.5 Chronotype and sleep quality

To determine if there were differences among the three chronotypes (evening, morning, neither) on the sleep quality components, a multivariate analysis of variance (MANOVA) was conducted. Equality of variance-covariance matrices was violated (Box'M=104.88, $F_{(56,23384)}$=1.75, p<.001); thus, Pillai's Trace is reported. Bartlett's test of Sphericity was significant (χ^2=252.12, df=27, p<.001) suggesting that the 7 components of sleep quality are sufficiently correlated. There was a significant difference among the three chronotypes on a linear combination of the 7 sleep quality components (Pillai's Trace=0.116, $F_{(14, 408)}$=1.80, p=.035, η^2=.058). Approximately 6% of the variance in sleep quality can be explained by chronotypes. Univariate analysis indicated that the three chronotypes were different only on sleep disturbance ($F_{(2,209)}$=1.77, p=.007, η^2=.047). Evening type students (M=1.52, SD=0.69) had significantly higher sleep disturbances than morning types (M=1.11, SD=0.58) or neither (M=1.20, SD=0.56). There were no differences between morning types and neither.

Table 8. Sleep quality mean and standard deviation by chronotype

Sleep Quality	Chronotype	M	SD	n
Subjective sleep quality	Evening type	1.10	0.77	29
	Neither type	1.16	0.74	108
	Morning type	0.92	0.65	75
Sleep latency	Evening type	1.38	0.90	29
	Neither type	1.27	1.00	108
	Morning type	1.35	0.92	75
Sleep duration	Evening type	1.28	1.07	29
	Neither type	1.56	0.93	108
	Morning type	1.63	0.88	75
Sleep efficiency	Evening type	0.62	0.86	29
	Neither type	0.67	0.99	108
	Morning type	0.53	0.79	75
Sleep disturbance	Evening type	1.52	0.69	29
	Neither type	1.20	0.56	108
	Morning type	1.11	0.58	75
Use of sleep medication	Evening type	0.31	0.81	29
	Neither type	.157	0.53	108
	Morning type	0.08	0.32	75
Daytime dysfunction	Evening type	1.17	0.93	29
	Neither type	0.96	0.83	108
	Morning type	0.76	0.79	75

3.6 Gender, year of study and sleep quality

Of interest to us were relationships between sleep quality and gender as well as between sleep quality and year of study. We conducted multivariate analysis of variance to examine these relationships. We found no significant gender differences on a linear combination of the 7 components of sleep quality (Wilk's Lambda=0.94, $F_{(7,204)}$=.09, η^2=.057). We also found no significant differences among year of study on the linear combination of the 7 sleep quality components (Wilk's Lambda=.892, $F_{(28,726)}$=0.84, η^2=.028)

4 Discussion

As measured by the PSQI, about 79% of the students at Rusangu University had poor sleep quality, although the same percentage of the students subjectively rated their sleep as 'good'. The students appear to have healthy lifestyle with less than 10% involved in substance use (smoke, alcohol, caffeine, use of psychostimulants). However, about 30% of the students sleep late (after 24:00 hours) or wake up early (as early as 0300 hrs). Overall, sleep quality appears to be unrelated to sleep hygiene or lifestyle variables, although use of sleep disturbances seems higher for those who use psychoactive substances (r=.158, p<.05). Sleep quality may also be related to sleeping behaviour patterns. Late sleepers or early risers tend to have higher sleep disfunction (r=.15 to r=.22, p<.05) and higher sleep disturbances (r=.14 to r=.21, p<.05). Evening type persons appear to experience higher sleep disturbances than other chronotypes. There were no gender differences on the linear combination of sleep quality indices. Neither were there differences in sleep quality across year of study.

The large percentage (79%) of students at Rusangu University with poor sleep quality as measured by the PSQI is consistent with other studies (Schwarz et al, 2013; Carney et al, 2006; Al-Kandari et al, 2017; Lukowski & Milojevich, 2013) which suggest that poor sleep quality among university students is a global phenomenon. Poor sleep patterns among university students may be due to academic, social, cultural and religious demands that are common in university life. Our results are consistent with Lemma et. al (2012) who reported that sleep quality was related to several psychological variables among university students in Ethiopia or that of *Suen et. al (2008) that reported the association between sleep behavior and sleep-related factors among university students in Hong Kong.* Rusangu University is a drug-free denominationally affiliated institution. Thus, it is not surprising that most of the students (70% - 94%) are not involved in using alcohol, tobacco and psychostimulants. This study found that Evening types reported higher sleep disturbances than other chronotypes. Evening chronotypes may have reported disturbances in part because of using electronic display within 2 hours before bedtime or in bed and living room which is bright at night. This, in turn, may result in the suppression of melatonin leading to poor sleep efficiency (Shimura et al.,2017; West et al., 2015). Our findings suggest that sleep quality is not related to sleep hygiene, sleep behaviour patterns or lifestyle which are inconsistent with that of Flaklin et al. (2002) among a university student population, LeBourgeois et al. (2005) among American and Italian adolescents, and Cameron et al. (2010) among medical students. This inconsistency requires further investigations.

Thus, recommendations from this study would include the following. Firstly, universities may seek to schedule classes along with other university programs in a way that permits

students to have an opportunity to plan well for their personal study as well as sleep routine. Secondly, universities would further consider providing early Psychoeducational programs and awareness about sleep health and best sleep hygiene practices. Finally, of importance to universities is assessing psychoeducational programs on sleep or implementing one in cases where there are none. On the research front, this study lays a foundation for a follow up study into how evening chronotype participants reported higher sleep disturbances than others. Another aspect of the study that calls for a follow up is why sleep quality does not seem to be related to sleep hygiene, sleep behavior patterns or lifestyle. Qualitative inquiries may provide better understanding of students' views and myths about sleep.

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