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Physical Activity And Sleep Patterns During the Month of Ramadan

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PHYSICAL ACTIVITY AND SLEEP PATTERNS DURING THE MONTH OF RAMADAN

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ABSTRACT

Purpose: This study aimed to assess the level of physical activity and sleep patterns in healthy Muslim adults during the month of Ramadan. **Methods:** Twelve males and seven females took part in this observational study. The International Physical Activity Questionnaire (IPAQ) was used to assess the level of physical activity. The consensus sleep diary (CSD) was used to measure sleep patterns. Assessments were a week before Ramadan, the last week of Ramadan, and the last week of the month following Ramadan. **Results:** The total activities decreased significantly during Ramadan compared to before and after Ramadan ($P < .05$). Vigorous and moderate activities were significantly lower during Ramadan ($P < .05$). There was no statistical differences in walking activity over the study periods. Data showed a significant postpone in bedtime and wake-up time during Ramadan. A significant decrease in wakefulness after sleep onset during Ramadan was reported. No change in total sleep time, nor quality of sleep were found. **Conclusion:** Data of this study revealed that Ramadan fasting is associated with postpone in bedtime and wake-up time. The total physical activities and sitting time were reduced during the month of Ramadan.

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CHAPTER I

INTRODUCTION

1.1 Background

Ramadan fasting, which occurs in the ninth month of the Islamic calendar, is one of the five pillars of the Islamic religion. The Gregorian year is eleven days longer than the lunar year, hence, the beginning of Ramadan fasting varies every nine years. The duration of fasting is affected by the season, which means that daytime is longer in the summer than in the fall. During the month of Ramadan, healthy Muslims, with the exception of children, women during menstruation, those who are ill and travelers, are obligated to fast from dawn to sunset. Fasting during this month includes refraining from food, drink and sexual activities.

During the month of Ramadan, the lifestyle of Muslims changes extensively. Muslims tend to socialize more by gathering with families, friends, and relatives. Ramadan fasting is the leading cause of modifications to some healthy lifestyles such as changes in sleep schedule and physical activities for those who take part. However, the lifestyle of some Muslims does not alter significantly during the month of Ramadan. For others, by contrast, this is an opportunity for worship and spiritual activities while some tend to engage in social activities with relatives and friends at night. For this latter group, changes in sleep parameters and level of physical activity are to be expected.

Several attempts have been made to investigate the effects of Ramadan fasting on sleep patterns, but the published studies are contradictory. A number of researchers have reported a significant delay or change in some sleep parameters during the month of Ramadan (Alzoghaibi et al., 2014; BaHammam, 2005; BaHammam, Alaseem, et al., 2013; BaHammam et al., 2014; BaHammam, Nashwan, et al., 2013; BaHammam et al., 2016; Boukhris et al., 2019; Roky et al., 2001). Other studies have shown that sleep parameters were not affected by Ramadan fasting (Bahammam, 2004; BaHammam et al., 2010; Herrera, 2012; Zerguini et al., 2007)

Further, several studies have been conducted on the effect of the month of Ramadan on the level of physical activity. However, their data were varied and inconsistent. Some research found a decline in physical activity during the month of Ramadan (Lessan et al., 2018; Racinais et al., 2012). However, other studies have reported that the level of physical activity remained unchanged during the month of Ramadan (Al-Hourani & Atoum, 2007; Geok et al., 2013; Poh et al., 1996).

In light of the current global pandemic, it is crucial to mention the effects that the coronavirus outbreak, also known as COVID-19, have had on some behavioral changes during the month of Ramadan. The outbreak of this virus has cast a long shadow over Muslims' lifestyle, which has been altered to conform with public health instructions provided by the World Health Organization (Zouhal et al.) on social distancing and most people have been requested to follow local guidelines, such as sheltering at home or self-isolation protocols, to prevent transmission of the virus. According to FitBit (Zouhal et al.), levels of physical activity declined significantly since the beginning of the pandemic.

Furthermore, data showed that sleep patterns were positively affected by COVID-19, with increased sleep duration.

1.2 Statement of the Problem

Muslims in the United States represent many nations, with different cultures, customs, education levels, working status and lifestyles. Because of these differences, it is natural that Muslims living in the United States vary in their daily habits during the month of Ramadan. These variations could possibly affect the level of physical activity and various sleep patterns. In addition, Muslims in the United States may have challenges in adapting to the attendant culture and lifestyle during the month of Ramadan. Muslims studying and working in the United States are used to engaging in Ramadan fasting in a different manner than in their home countries. Some of these lifestyle changes are predominately caused by reducing working hours, and delaying the closure of shopping centers and malls until after midnight (Bahammam, 2006).

Although extensive research has been carried out on Ramadan fasting, the current status of sleep patterns and the level of physical activity for Muslims living in the United States remains unclear during the month of Ramadan. To the investigator's knowledge, this is the first attempt to understand the degree to which Ramadan fasting alters the level of physical activity as well as sleep patterns among Muslims living in the United States. Therefore, this study aimed to shed a light on the possible changes in physical activity and sleep patterns that may occur during the month of Ramadan for Muslims living in the United States.

1.3 Purpose of the Study

The aim of the present study was to assess the level of physical activity during the month of Ramadan. In addition, this study aims to track Muslims' sleep patterns during that period.

1.4 Hypotheses

It was hypothesized that the amount of physical activity would be significantly reduced during the month of Ramadan compared to before and after Ramadan. It was also hypothesized that bedtime and wake-up time would be significantly postponed during Ramadan.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In the literature on Ramadan fasting, the relative importance of its effect on individuals' health has been the subject of considerable discussion. Yet, tracking physical activity and sleep patterns have received scant attention in the research literature. Furthermore, previously published studies on physical activity and sleep patterns during the month of Ramadan are inconclusive and inconsistent. The following literature related to the level of physical activity and sleep patterns during Ramadan has been reviewed in chronological order.

2.2 Physical Activity During Ramadan

Ramadan fasting is considered one of the intermittent fasting methods performed by healthy Muslims around the globe. The last two decades have seen a growing trend towards intermittent fasting as a nonpharmacologic and behavioral treatment of obesity (Jane et al., 2015) and type 2 diabetes ((Furmli et al., 2018). Zouhal and colleagues (Zouhal et al., 2020) considered the practice of engaging in physical activity while fasting and found that the enhanced use of adipose tissues due to increased lipolysis and subsequent peripheral fat oxidation led to weight loss and increased fat metabolism.

Howley, (2001) defined physical activity as "any bodily movement produced by contraction of skeletal muscle that substantially increases energy expenditure". Several attempts have been made to observe the level of physical activity during the month of Ramadan. However, previously published research investigating the physical activity levels were inconsistent. This inconsistency could be attributed to the sample size or research instruments used.

Fifty-one boys and 66 girls between the ages of 10 and 13 years participated in a study conducted by Poh and colleagues to assess the changes in activity patterns during Ramadan(Poh et al., 1996). Participants were asked to record their daily activity for two different times including a week prior to Ramadan and in the third week of Ramadan. The findings were that boys spent 26 ±19 mins/day in moderate activity during Ramadan and 51 ±40 mins/day during the non-fasting period. In contrast, data showed that girls were less active than boys, recording 20 ±12 mins/day during Ramadan and 24 ±20 mins/day in the non-fasting period.

Al-Hourani & Atoum, (2007) investigated the effect of Ramadan fasting on body composition, dietary intake, and physical activity. Fifty-seven females took part in this study. They were asked to complete a three-day activity diary as well as a food intake record for one week before Ramadan and for three weeks during the month of Ramadan. Body composition was assessed using bioelectrical impedance analysis (BIA) and the standard formula of BMI. This study found that body weight and BMI decrease significantly during the month of Ramadan. In addition, it was found that the means of energy and nutrients decreased during Ramadan but they were not statistically significant

and the physical activity patterns remained similar. The authors suggested that this study may be useful for weight loss programs among obese individuals.

Physical activity patterns during the month of Ramadan could be influenced by various factors. Geok et al., (2013) compared the physical activity of 53 males and 54 females during the month of Ramadan. Part of this study aimed to investigate the factors that could affect healthy Muslims engaging in physical activity during that time. The Yamex-Digi Walker CW700 pedometer was used to assess the level of physical activity during four different periods including a month prior to the month of Ramadan, the third and fourth weeks of Ramadan and the third or fourth weeks following Ramadan. Subjects were also given a questionnaire designed to examine the factors restricting their physical activity involvement. They found that the means of the physical activity level for both genders decreased significantly during Ramadan (6423 ±2376 steps/day) compared with the pre-Ramadan (7307 ±2726 steps/day) and post-Ramadan (7612 ±2904 steps/day) periods. In addition, males recorded more daily steps than females at each assessment but this was not statistically significant. Subjects reported that a lack of self-motivation and laziness were the critical factors that restricted their engagement in physical activity.

In an attempt to examine the effect of Ramadan fasting on the distribution of activity patterns, (Racinais et al., 2012) studied 11 moderately active males who wore a tri-axial accelerometer to assess their physical activity level for three consecutive days at each of four assessment points, namely, a month and a week before Ramadan, the last week of, and a month after Ramadan. In addition, BIA was used to evaluate body composition and electromyogram (EMG) data was obtained for muscle function and activity assessment. It was found that during Ramadan, the total number of steps were similar to those recorded

outside Ramadan. However, while the distribution of activity was similar during the assessment points before Ramadan, it was different during Ramadan. The data showed that activity patterns were higher in Ramadan from 2-5 am. Body composition and muscle function did not differ significantly before, during and after Ramadan. The authors stated that Ramadan causes a disorder in circadian rhythm.

Another study (Lessan et al., 2018) investigated the effect of Ramadan fasting on activity and energy expenditure. In this study, 16 healthy females and 13 males were divided into subgroups: activity (6 males; 5 females) and total energy expenditure (5 males; 5 females). Activity and total energy expenditure were measured using ActiGraph GT9X and doubly labeled water, respectively. Measurements were obtained during the month of Ramadan and two months after Ramadan. The findings were that activity levels during Ramadan were significantly lower (9950 ±1152 steps/day) than post-Ramadan (11353 ±2054 steps/day). There was no significant difference in total energy expenditure during Ramadan (2224 ±433 kcal/day) and post-Ramadan (2121 ±718 kcal/day). Lessan and colleagues indicated that these findings could apply to dietary restriction programs which center on spacing and skipping meals.

Table 1.
Summaries of previous studies investigating the changes in physical activity during the month of Ramadan

Reference	Country	Sample	Age	Instrument	PA level
(Poh et al., 1996)	Malaysia	51M;66F	11.5 ±1.5	Diary sheet	Decreased
(Al-Hourani & Atoum, 2007)	Jordan	57 F	21.6 ±4.14	Activity diary	Decreased
(Geok et al., 2013)	Malaysia	53M; 54F	22-55	Yamax Pedometer	Decreased
(Racinais et al., 2012)	Qatar	11M	31.0 ±3.0	Accelerometer	Decreased*
(Lessan et al., 2018)	England	6M; 5F	34.1 ±7.3	ActiGraph GT9X	Decreased*

M: male subjects; F: female subjects; *: significant compared to baseline

2.3 Sleep Patterns During the Month of Ramadan

Roky et al., (2001) investigated the effect of intermittent Ramadan fasting on nocturnal sleep patterns. Eight healthy Muslims were assessed two weeks prior to Ramadan, during the first week and the last week of Ramadan and two weeks after Ramadan. Sleep variables were assessed using Polysomnography (PSG). It was reported that total sleep time decreased significantly during Ramadan from 422 mins at baseline to 381 mins at the beginning of Ramadan and 383 mins at the end of Ramadan. The findings also showed that there was a significant postponement of bedtime from 23:48 pm (baseline) to 00:36 am (Ramadan I), 00:41 am (Ramadan II), and 23:52 pm (post-Ramadan). However, awakening times were delayed significantly during Ramadan (8:52; 9:08 am) compared with baseline (8:03 am) and post-Ramadan (8:32 am). Roky and colleagues argue that the inversion of the food and drinks schedule played an important role in affecting sleep patterns.

A similar study by (Bahammam, 2004) aimed to assess daytime sleepiness during the month of Ramadan. A daily sleep diary was given to each subject to assess total sleep time, bedtime, nap duration and wake-up time. Eight healthy subjects (31.8 ±2 years old)

took part in this study and completed the diary at three different times, including two weeks before Ramadan and the first and third weeks of Ramadan. It was found that bedtime was delayed in Ramadan (1 ±2.3; 1.3 ±2.8) compared with the baseline (23.7 ±1.3). Wake-up time did not change significantly, which led to a decrease in total sleep time at night during Ramadan (4.7 ±1.7 h; 4.8 ±1.8 h) compared with the baseline (6.8 ±1.1 h).

In an attempt to investigate the effect of Ramadan fasting on sleep in fasting and non-fasting individuals, BaHammam, (2005) conducted a comparison study which included 41 fasting Saudis, 30 fasting non-Saudis, and 30 non-fasting non-Saudis. Each participant was asked to complete a predesigned questionnaire one week before Ramadan and in the first and the third weeks of Ramadan. For all groups, total sleep time or daytime sleepiness was found not to change. However, it was reported that bedtime was postponed significantly during the first week of Ramadan in Saudi fasting participants (02:06 ±16; 02:36 ±19 mins) compared with the baseline (00:36 ±19 mins) and non-Saudi fasting participants (02:20 ±58; 02:12 ±59 mins) compared with the baseline (23:56 ±36 mins). The author concluded that sleep behavior among non-Saudi fasters was affected by the attendant lifestyle changes during the month of Ramadan.

In efforts to examine Ramadan's effect on total sleep time and quality of sleep in athletic individuals, Zerguini et al., (2007) surveyed 48 professional soccer players (aged 17-34) before, at the end, and two weeks after Ramadan. Total sleep time was reduced during the month of Ramadan by nearly 30 minutes. In addition to the decrease in total sleep time, 61.5% of participants reported that sleep quality was slightly worse during Ramadan. (Zerguini et al., 2007) indicated that this could be attributed to the disruption of the sleep cycle to accommodate dietary intake.

Part of a study conducted by Chennaoui et al., (2009) aimed to assess the total sleep time in middle-distance runners during the month of Ramadan. Eight middle-distance runners with a mean age of 25 ±1.3 years were asked to complete a sleep log the week before, during the first and last weeks of, and the week after the month of Ramadan. They found that sleep time was reduced significantly during the last week of Ramadan (350.3 ±27 minutes), compared with the baseline (236 ±40.4 minutes), the first week of Ramadan (474.3 ±28.8 minutes) and the week following Ramadan (404.3 ±34.2 minutes). This study neglected to specify the results of other sleep variables that were included in the sleep log although the authors had mentioned that sleep logs consist of questions related to bedtime, wake-time, sleep latency and awakening periods.

The circadian pattern of sleep during the month of Ramadan was investigated by (BaHammam et al., 2010). In this study, six healthy Muslims were assessed a week before Ramadan, during the first week and again during the second week of Ramadan. A portable armband device, placed at the triceps of the right arm, was used in this study. The findings were that wake time during the first week of Ramadan was delayed significantly (12.68 ±1.41 h) compared with the baseline (10.42 ±1.87 h) and the second week of Ramadan (11.76 ±2.32 h). Although wake up time was delayed, the data showed clear delays in bedtime during the three periods, but they were not statistically significant.

A study by Herrera, (2012) aimed to investigate the influence of the month of Ramadan on sleep patterns of athletic individuals. In this study, nine football athletes (26 ±4 years) attending physiotherapy were asked to fill out the Pittsburgh Sleep Quality Index (PSQI) one week before and during the last week of Ramadan. The results of this study showed a significant reduction in the total sleep time during Ramadan (5.3 ±1.4 h)

compared with the baseline (6.6 ±1.5 h). Furthermore, sleep latency did not significantly increase during Ramadan (24.2 ±15 min) compared with the baseline (18.5 ±10 min). The authors concluded that the injury recovery period could be attributed to the poor quality of sleep in male Muslim soccer players during Ramadan.

BaHammam, Alaseem, et al., (2013) studied eight Muslims (36.25 ±4 years) and eight non-Muslims (34.75 ±3 years) to examine the effect of Ramadan on sleep patterns and daytime sleepiness. Data collection took place a week before Ramadan and during the first and second weeks of Ramadan. The senseWearPro Armband™ and a sleep diary were used to assess total sleep time and sleep patterns, respectively. The data showed a significant postponement of bedtime for Muslims during the first and second weeks of Ramadan (0.89 ±1.87 h and 1.13 ±1.79 h, respectively) compared with the baseline (23.57 ±1.17) and the wake-up time (7.02 ±2.53 h; 7.08 ±2.4 h), respectively. In addition, the total sleep time decreased significantly during the first and second week of Ramadan (P <0.001). In contrast, bedtime, wake-up time and total sleep time did not differ significantly in non-Muslims for all periods, except for the nap bedtime, which reduced significantly during the first week of Ramadan. These differences in sleep patterns between Muslims and non-Muslims may be due to the fact that the beginning of working hours were shifted to 10 AM instead of 7:30 AM among Muslim participants in Ramadan, whereas working hours remained the same as before Ramadan for non-Muslims.

In a study by Alzoghaibi et al., (2014) investigating the effect of intermittent fasting in the absence of lifestyle changes that occur during Ramadan, eight healthy Muslims (26.6 ±4.9 years) were studied during the first week of Shaaban (baseline fasting), the last week of Shaaban (baseline non-fasting) and the second week of Ramadan. Sleep pattern data

were obtained using actigraphy when sleeping at home, while total sleep time and sleep latency were measured using polysomnography. The data showed a significant delay in mean bedtime during Ramadan (2:42 am) compared with baseline fasting (1:30 am) and baseline non-fasting (00:36 am). Mean wake-up time was also postponed significantly during Ramadan (8:48 am) compared with baseline non-fasting (5:30 am) and baseline fasting (6:12 am). No significant difference was found in sleep latency and total sleep time in all assessment periods.

A similar study was conducted by BaHammam, Nashwan, et al., (2013) to explore the effect of intermittent fasting on sleep patterns during Ramadan. In this study, actigraphy monitors were placed on the wrist of eight healthy Muslims (25.3 ±2.9 years), who undertook Islamic fasting during the first week of Shaaban in the absence of the lifestyle changes of Ramadan. Data were collected during the first week of Shaaban (fasting), the last week of Shaaban, and the second week of Ramadan. It was found that bedtime and wake-up time did not differ significantly during the first week of Shaaban (fasting) compared with the last week of Shaaban and Ramadan. However, significant delays were found for bedtime and wake-up time during Ramadan ($P > 0.05$). These results suggest that the lifestyle adopted during Ramadan plays a crucial role in affecting the sleep schedule compared with practicing the same type of fasting outside of Ramadan.

Another study by the same authors (BaHammam et al., 2016) aimed to investigate the role of Ramadan fasting on sleep patterns by controlling for the lifestyle and eating habits to mimic the fasting during Ramadan. For this purpose, eight healthy Muslims (26.6 ±4.9 years) were asked to practice intermittent fasting on the first week of Shaaban only. Each participant was asked to wear an actigraphy monitor on the nondominant wrist. The

monitor was used to assess the regular sleep schedule in the first week (fasting), the last week of Shaaban and the second week of Ramadan. There was a significant postponement in the mean bedtime during Ramadan (2:42 AM) compared with the first and last weeks of Shaaban (1:30 am and 00:36 am, respectively). There were no significant changes in total sleep time, sleep latency, and sleep efficiency between the three periods.

Boukhris et al., (2019) conducted a subjective study attempting to examine sleep patterns before, during, and after Ramadan. Fourteen healthy participants (21.6 ±3.3 years) took part in this study and completed the Arabic version of the Pittsburgh Sleep Quality Index to measure sleep patterns subjectively before, during and after Ramadan. The data showed a significant change in sleep duration during Ramadan (6.1 ±1.5 h) compared with the periods before (7.9 ±1.6 h) and after (6.9 ±1.4 h) Ramadan. The findings were that the sleep quality score was higher during and after Ramadan (2.0 ±0.70 and 1.6 ±0.9, respectively) compared with the period before Ramadan (0.9 ±0.9).

A study by Hsouna et al., (2019) aimed to subjectively assess sleep parameters before Ramadan, during the first week and the last week of Ramadan, as well as 10 days and 20 days after Ramadan. Twelve healthy men (21.9 ±2.4 years) were asked to complete the Pittsburgh Sleep Quality Index (PSQI). The results of this study showed no changes in sleep latency in all periods. Nevertheless, sleep duration reduced significantly during the two assessment points after Ramadan (6.50 ±1.62 h and 6.67 ±1.68 h, respectively) compared with the two periods during Ramadan (7.83 ±1.40 h and 7.50 ±1.73 h, respectively). Furthermore, the subjective sleep quality score was higher during the second week of Ramadan (2.00 ±0.20) compared with the baseline level (1.07 ±0.25) and after Ramadan (1.67 ±0.21).

Table 2.
Summaries of previous studies investigating sleep patterns during the month of Ramadan

Reference	Country	Sample	Instrument	Bedtime	Wake-up	TST	SOL	QOS
(Roky et al., 2001)	Morocco	8 males	PSG	Postponed*	Postponed*	Decreased*	Increased*	-
(Bahammam, 2004)	KSA	8 males	Sleep diary	Postponed	Postponed	Decreased*	Decreased*	-
(BaHammam, 2005)	KSA	71 males	Sleep diary	Postponed*	Postponed*	Varied	-	---
(Zerguini et al., 2007)	Algeria	48 males	Sleep diary	-	-	Increased	-	Lower
(Chennaoui et al., 2009)	France	8 males	Sleep diary	-	-	Decreased*	-	-
(BaHammam et al., 2010)	KSA	7 males	Actigraphy	Varied	Postponed*	Varied	-	-
(Herrera, 2012)	Qatar	9 males	Sleep diary	-	-	Decreased*	Increased*	Higher
(BaHammam, Alaseem, et al., 2013)	KSA	8 males	Actigraphy	Postponed*	Postponed*	Decreased*	-	-
(BaHammam, Nashwan, et al., 2013)	KSA	8 males	Actigraphy	Postponed	Postponed*	Decreased	Decreased	-
(Alzoghaibi et al., 2014)	KSA	8 males	Actigraphy	Postponed*	Postponed*	Varied	Decreased	-
(Alzoghaibi et al., 2014; BaHammam et al., 2016)	KSA	8 males	Actigraphy	Postponed*	Postponed*	Decreased	Increased	-
(Boukhris et al., 2019)	KSA	8 males	Actigraphy	Postponed	Postponed*	Decreased	Increased	Higher

TST= total sleep time; SOL= sleep onset latency; QOS= quality of sleep; * considered a significant difference

CHAPTER III

METHODS

3.1 Research Design

This was an observational study with repeated measures. The independent variable is Ramadan fasting. The dependent variables are physical activity and sleep patterns. This study was conducted during the month of Ramadan in the year of 1442 Hijri (between April 23 and May 24, 2020). During the study period in Ramadan, dawn (beginning of fasting) ranged between 4:25 am and 5:09 am and sunset (end of fasting) ranged between 08:17 pm and 08:47 pm. This study was limited to healthy Muslim adults, aged 18-60, who were intending to fast for the month of Ramadan. The study procedures were approved by the institutional review board committee at Cleveland State University (Appendix B).

3.2 Subjects

A convenience sample of twenty-nine healthy Muslim volunteers was recruited into this study. Flyers (Appendix C) were posted on the Muslim Students' Association social media network. Inclusion criteria included healthy Muslims ranging in age from 18-60, who planned to fast for the month of Ramadan. Volunteers with pacemakers or other electronic medical devices were excluded. Volunteers with acute chronic disease or prescribed medications were also excluded from this study.

3.3 Research Instruments

International Physical Activity Questionnaire (IPAQ). This study used the International Physical Activity Questionnaire (short version) to measure the participants' physical activity levels for seven consecutive days at the baseline level (a week before Ramadan), midline level (the last week of Ramadan), and the end-line level (a week after Ramadan). The IPAQ has been previously reported to be valid and reliable in a study including 12 countries (Craig et al., 2003). It measures physical activity levels by asking participants to report their daily activity in terms of frequency, duration and intensity of physical activity during the previous seven days at each assessment period. The Metabolic Equivalent of Task (MET) method was used to score the IPAQ, in which levels of intensity and different activity are assigned different MET estimates. For the purpose of this study, total MET-minutes/week will be separately calculated for each intensity (Haskell et al., 2007).

The Consensus Sleep Diary. The Core Consensus Sleep Diary (CSD) is a self-monitored sleep diary questionnaire, which is primarily used to track an individual's sleep for seven consecutive days. This diary is the product of a concerted effort by sleep experts to recognize the essential parameters of sleep self-monitoring (Carney et al., 2012). The Core Consensus Sleep Diary consists of a total of nine questions: 1) time getting into bed; 2) time trying to go to sleep; 3) sleep onset latency; 4) number of awakenings during sleep; 5) duration of awakenings; 6) time of the final awakening; 7) the final wake-up time; 8) quality of sleep; 9) any comment regarding the participant's sleep (Carney et al., 2012). The response format of each question included in this sleep diary is presented in Table 2.

Table 3.
The response format of the Core Consensus Sleep Diary items

	CSD Items	Response format
1	What time did you get into bed?	Hours and minutes
2	What time did you try to go to sleep?	Hours and minutes
3	How long did it take you to fall asleep?	minutes
4	How many times did you wake up, not counting your final awakening?	Number
5	In total how long did these awakenings last?	minutes
6	What time was your final awakening?	Hours and minutes
7	What time did you get out of bed for the day?	Hours and minutes
8	How would you rate the quality of your sleep?	Likert scale; 0=very poor; 1=poor; 2=fair; 3=good; 4=very good
9	Comments (if applicable)	For example: I had a cold

3.4 Procedures

The study was performed during the last week of Shaaban (a week before Ramadan) which was used as the baseline level (BL), the last week of Ramadan and the last week of the following month. The Consensus Sleep Diary (Appendix E), the International Physical Activity Questionnaire (Appendix D), informed consent (Appendix F) and the pre-study survey (Appendix A) were mailed to 29 participants in a prepaid envelope which was labeled with an ID identifying each participant. Each participant was asked to retain these materials for the study periods and, at the conclusion of the final study period, to return them to the investigator's address that was stamped on each envelope.

For the sleep assessment, participants were asked to fill out the survey every day within 30 minutes after getting out of bed in the morning for seven consecutive days during

any week before Ramadan, the last week of Ramadan and the last week of the following month. In addition, participants were informed that this study was observational and that they were not required to change their observance of Ramadan in any way. Furthermore, the items included in the sleep diary were explained and illustrated in detail to the participants.

For the physical activity assessment, participants were requested to report their weekly physical activity by completing the IPAQ, which is designed to assess the physical activity level for the previous seven days. The compendium of activities reported by (Haskell et al., 2007) was taken into account when instructing participants about classifying physical activity intensities.

Throughout the study periods, the researcher was in close contact with participants, reminding them about the times for completing the sleep diary and IPAQ. Furthermore, participants were informed that they could report any concerns or ask questions regarding the research instruments.

3.5 Data Analysis

Data was entered and analyzed using the Statistical Package for Social Sciences (SPSS), version 25. Data is presented as descriptive statistics in the form of means and standard deviations. A one-way repeated-measures ANOVA for continuous variables was used to compare the changes in physical activity and sleep patterns across the assessments. When the ANOVA indicated significant differences, post-hoc multiple comparison tests between assessments were performed and the Bonferroni p level adjustment applied for multiple comparisons. Differences were considered statistically significant at $p \leq 0.05$.

CHAPTER IV

RESULTS

4.1 Demographic Information

This thesis intended to determine the extent to which the month of Ramadan altered sleep patterns and whether this month had an effect on the level of physical activity in healthy Muslim adults. By the end of the study period, data had been collected from 29 individuals (28.4 ±6.6 years), 17 (58.6%) of whom were male with a mean age (27.2 ±5.3) and 12 (41.4%) were female with a mean age (30 ±7.9).

Table 4.
Demographic Characteristics of the Participants

Variable	Male	Female	Total
Number	17 (58.6%)	12 (41.4%)	29 (100%)
Age (mean ± SD)	27.2 ±5.3	30 ± 7.9	28.4 ±6.6

4.2 Sleep Patterns

Data of the Consensus Sleep Diary are presented in Table 4, before, during, and after Ramadan. It can be seen that there is a significant postpone in bedtime during the month of Ramadan compared to that in before and after Ramadan (P= 0.004). This postpone in bedtime has consequently postponed the wake-up time significantly during the month of Ramadan ($p < .001$). Data showed an increase in sleep onset latency during the

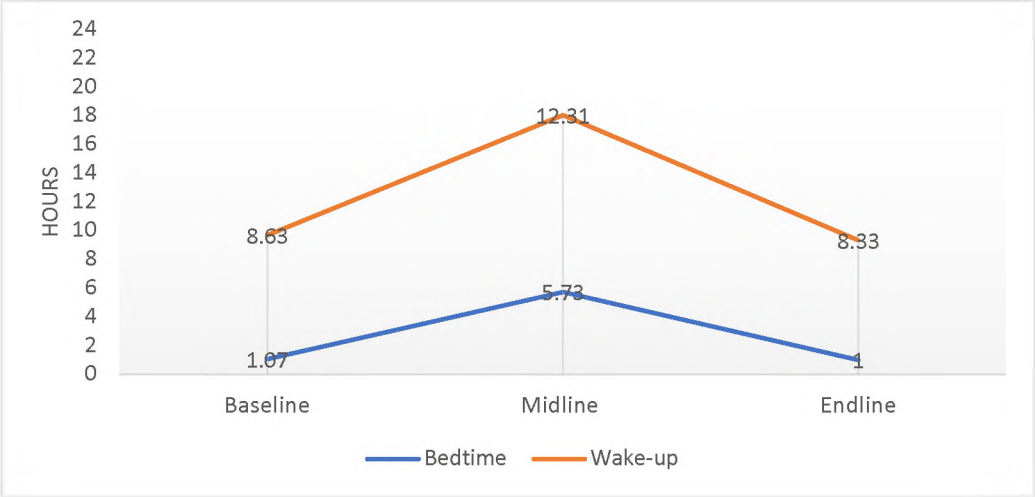
month of Ramadan but was not statistically significant (p = .320). A significant increase was detected in wakefulness after sleep onset during Ramadan (p < .001). In addition, data showed a lower score of Quality of sleep during Ramadan but was not found to be statistically significant. Figure 1 shows the changes in bedtime and wake up according to the CSD. As can be seen from this graph, bedtime and raising time were postponed significantly during the month of Ramadan compared to before and after Ramadan.

Table 5.
Sleep Patterns during the three study periods measured using the Consensus Sleep Diary.

Variable	Before Ramadan	Ramadan	After Ramadan	P value
Bedtime (24 h)	1.07 ±1.94	5.73 ± .75^{+*}	1.00 ± 2.01	.004
Wake-up (24 h)	8.63 ±2.31	12.31 ±3.27^{+*}	8.33 ±1.71	.000
SOL (min)	17.98 ±7.83	20.27 ±12.8	17.32 ±8.16	.320
WASO (min)	29.25 ±25.48*	41.16 ±33.53	14.64 ±10.73$^{\#}$	.000
QOS	3.74 ± .62	3.5 ± .76	3.76 ±.61	.150
TST (h)	6.42 ±1.05	6.54 ±1.12	6.04 ±1.18	.149
Sleep Efficiency (%)	83.55 ±5.3$^{\#}$	79.62 ±5.17^{+*}	84.7 ±3.9	.000

SOL: Sleep after Onset Latency; WASO: Wakefulness After Sleep Onset; QOS: Quality of Sleep; TST: Total Sleep Time.
+: significant difference compared to before Ramadan
#: significant difference compared to Ramadan
*: significant difference compared to after Ramadan

Figure 1.
Change in bedtime and wake up time in all assessment periods



4.3 Physical Activity

The results obtained from the current analysis of IPAQ-SF are presented in Table 5. It can be seen that participants performed less vigorous physical activity during Ramadan (97.93 ± 235.58 METs min/week) in comparison with the vigorous activity performed before (302.07 ±388.79 METs min/week) and after Ramadan (377.93 ± 653.66 METs min/week). Likewise, participants reported a significantly lower amount of moderate activity during Ramadan (104.83 ±165.07 METs min/week), compared to before (268.28 ±303.01 METs min/week) and after Ramadan (273.8 ±340.13 METs min/week). By contrast, the analysis did not show any significant differences in walking activity in all assessment periods ($p > .05$). Taken together, participants achieved significantly lower activity carried out during the month of Ramadan (521.9 ±392.5 METs min/week) in comparison with before and after Ramadan (830.38 ±729.8, 791.93 ±700.3 METs min/week; respectively). Additionally, as shown in Table 5, the average of daily sitting time increased significantly during Ramadan (13.21 ±2.47 h) compared to before (7.72 ±3.84 h) and after Ramadan (7.79 ±3.96 h)

Table 6.
The average MET min/week and sitting time carried out by participants before, during and after Ramadan.

Variable	Before Ramadan	Ramadan	After Ramadan	P value
Vigorous METs (min/week)	302.07 ±388.79	97.93 ± 235.58[+*]	377.93 ± 653.66	.025
Moderate METs (min/week)	268.28 ±303.01	104.83 ±165.07[+*]	273.8 ±340.13	.032
Walking METs (min/week)	17.98 ±7.83	20.27 ±12.8	17.32 ±8.16	.070
Total METs (min/week)	830.38 ±729.8	521.9 ±392.5	791.93 ±700.3	.040
Siting time (h/day)	7.72 ±3.84[*]	13.21 ±2.47	7.79 ±3.96[#]	.000

+: significant difference compared to before Ramadan
#: significant difference compared to Ramadan
*: significant difference compared to after Ramadan

Based on data obtained concerning the intensity and frequency of physical activity performed before, during, and after Ramadan, participants were classified as a low, moderate, or high level in the IPAQ-SF classification. The percentages breakdown into the IPAQ-SF classification are set out in Table 6. A total of 72.4% of participants fell into the low level of PA during Ramadan, as compared to (58.6, 54.5%) before and after Ramadan; respectively. A moderate level of PA was identified for (24.1%) during Ramadan and nearly one-third of participants were found to have the same level before (34.5%) and after Ramadan (35.2%). Only (3.4%) of participants were examined as high level of PA during Ramadan and 6.9% were found to have the same level before Ramadan, while 10.3% were noted to be highly active after Ramadan.

Table 7.
The percentage breakdown of participants into a high, moderate or low level of physical activity, according to IPAQ-SF classification.

IPAQ level	Before Ramadan	Ramadan	After Ramadan
High	6.9%	3.4%	10.3%
Moderate	34.5%	24.1%	35.2%
Low	58.6%	72.4%	54.5%

CHAPTER V

DISCUSSION

The present study aimed to observe any possible changes in physical activity and sleep patterns among those performing Ramadan fasting from dawn to sunset for 28-30 consecutive days. To the best of the investigator's knowledge, this is the first attempt to assess the level of physical activity and sleep patterns during the month of Ramadan in the United States. The practice of Ramadan fasting in non-Islamic countries is presumably less common. It has been suggested that the attendant lifestyle and culture changes play a role in modifying individuals' behavior (BaHammam, Alaseem, et al., 2013).

5.1 Sleep Patterns

The current findings showed that bedtime and raising time were significantly delayed during Ramadan. These findings are in accord with previous studies indicating that Ramadan fasting is associated with significant postpone in bedtime and wake-up time (Alzoghaibi et al., 2014; Bahammam, 2004; BaHammam, Alaseem, et al., 2013; BaHammam, Nashwan, et al., 2013; BaHammam et al., 2016; Roky et al., 2001). In agreement with others (Alzoghaibi et al., 2014; BaHammam, 2005; BaHammam et al., 2010; BaHammam, Nashwan, et al., 2013; BaHammam et al., 2016; Boukhris et al., 2019; Zerguini et al., 2007), this study did not show any significant change in total sleep time

across all assessments. In contrast to earlier findings (Bahammam, 2004; Herrera, 2012; Roky et al., 2001), no evidence of sleep onset latency was detected from this study. Conflicting findings in measuring TST and SOL during Ramadan were noted in recent studies. The observed inconsistency in reported results could be interpreted as being a result of the various methods of sleep assessments.

Additionally, previous studies of Ramadan have not dealt with wakefulness after sleep onset. This study, however, found that WASO increased significantly during the month of Ramadan. It is crucial to indicate that the significant increase in WASO did not adversely affect quality of sleep in this study. Previous studies have reported conflicting results on the effect of Ramadan fasting on quality of sleep. Although some studies using the subjective measurements have reported a high score in quality of sleep during the entire month of Ramadan (Boukhris et al., 2019; Herrera, 2012), others revealed a lower score (Zerguini et al., 2007)

The uniqueness of Ramadan is that Muslims are obligated to fast during daylight hours. Therefore, timing of meals are typically shifted to night hours. Besides, the significant postpone in bedtime during the month of Ramadan can be explained by additional activities, such as family visits, late night prayers, or shopping. The major shift in bedtime and rising time reported during the month of Ramadan can possibly lead to disturbance in circadian rhythm (Almeneessier et al., 2018). It has been shown that circadian disturbance is associated with the increased risk of obesity, diabetes, and cardiovascular disease (Reutrakul & Knutson, 2015).

5.2 Physical Activity

The present study measured the level of physical activity subjectively using the International Physical Activity Questionnaire (IPAQ). In general, the level of physical activity was reported to be significantly lower during the month of Ramadan as compared to before and after Ramadan. However, intensities of physical activity were not performed similarly. For example, engaging in vigorous and moderate activities during Ramadan was significantly lower, unlike walking activity which was not altered significantly. These results differ from other's (Al-Hourani & Atoum, 2007; Poh et al., 1996; Racinais et al., 2012) previous estimates of the level of physical activity during the month of Ramadan, but they are broadly consistent with earlier investigations (Geok et al., 2013; Lessan et al., 2018). Additionally, these findings reported a significant decrease in sitting time.

Conflicting findings of previously published studies on the effect of Ramadan fasting on the level of physical activity are noted. This discrepancy could be attributed to the variation of measuring instruments. Some of the previous studies utilized a self-reported questionnaire, daily activity logs, or activity dairy to estimate the level of physical activity during the month of Ramadan (Al-Hourani & Atoum, 2007; Poh et al., 1996). Others used objective measurements, including wearable devices such as accelerometers and pedometers (Geok et al., 2013; Racinais et al., 2012) or doubly labeled water to measure the energy expenditure (Lessan et al., 2018). Strengths and limitations of these methods can be found elsewhere (Ndahimana & Kim, 2017). Moreover, It seems possible that these contradictory results are due to the sample size. In addition, the attendant lifestyle in Ramadan was found to be a crucial factor that can impact the results of previous studies. Working hours, for example, are diminished in most Islamic countries from 8:00 – 4:00

pm to 10:00-2:00 pm. Besides, shopping malls and supermarkets remain open until late night. It has been suggested that the attendant lifestyle and cultural changes can play a role in affecting the behavior of individuals regardless of fasting (BaHammam, Alaseem, et al., 2013). These results have further supported the hypothesis that the level of physical activity would be lower during the month of Ramadan as compared to before and after Ramadan.

5.3 Limitations of the Study

The findings of this study should be interpreted in light of some limitations. First, it was not possible to assess body composition and eating habits in this study due to COVID-19 restrictions; therefore, it is unknown if the results of this study were impactful on dietary intake or the values of body composition. Second, findings of this study are applicable to healthy Muslims in non-Islamic countries and cannot be generalized to all Muslims due to the absence of the attendant lifestyle in Ramadan. Finally, this study was limited by subjective assessments which have been well-reported, and also incorporate desirability bias (Ferrari et al., 2007; Sallis & Saelens, 2000).

5.4 Future Research Recommendations

As a result of this study, the following recommendations are made for future research:

1. A similar study should be conducted using objective measurements to better assess the level of physical activity and sleep patterns.
2. A comparison study should be undertaken, comparing the practice of Ramadan fasting in Islamic and non-Islamic countries.
3. A further experimental study could assess the effects of intensity and timing of physical activity in relation to cardiometabolic risks.

CHAPTER VI

SUMMARY AND CONCLUSION

The aim of the present study was to examine the level of physical activity and sleep patterns during the month of Ramadan. The most obvious finding to emerge from this study is that bedtime and wake-up time delayed significantly during the month of Ramadan as compared with before and after Ramadan. In addition, total sleep time and sleep onset latency did not differ significantly across all assessments. The current study has also shown a significant change in wakefulness after sleep onset and sleep efficiency during Ramadan in comparison with that before and after Ramadan.

The results of this study suggest that Ramadan is associated with reduced physical activity, and increased sitting time during the month of Ramadan. Ramadan fasting results in variations of activity intensity but the overall walking activity does not appear greatly affected compared with vigorous and moderate activities which were significantly reduced during Ramadan.

Furthermore, this study has gone some way towards enhancing our understanding of the level of physical activity and sleep patterns during the month of Ramadan outside of predominantly Muslims areas. Given that our findings are based on limited measuring instruments and small sample size, the results from such analyses should be interpreted

with caution. Results of this study might not be representative of all Muslims given the differences in culture changes and attendant lifestyle of Ramadan.

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APPENDIX A

Changes in physical activity and sleep patterns during Ramadan

Pre-Study Survey

ID:

1. **Age: ……**
2. **Gender:**

☐ Male ☐ Female

3. **Do you partake in the fast associated with the observance of Ramadan?**

☐ Yes ☐ No

4. **Are you fluent in English as a first or second language?**

☐ Yes ☐ No

5. **Contact Information**

☐ Cell phone: ☐ Email:

Name (please print)	Signature	Date
Witness (please print)	Signature	Date

APPENDIX B

March 9, 2020

Dear Douglas Wajda,

RE: IRB-FY2020-199
Body Composition, blood lipids, glucose and sleep during Ramadan associated fasting

The IRB has reviewed and approved your application for the above named project under the category noted below.
Application renewal is not necessary unless indicated below.

Approval Category: Expedited Category 2a & 7
Approval Date: March 9, 2020
Expiration Date: --

By accepting this decision, you agree to notify the IRB of: (1) any additions to or changes in procedures for your study that modify the subjects' risk in any way; and (2) any events that affect that safety or well-being of subjects. Notify the IRB of any revisions to the protocol, including the addition of researchers, prior to implementation.

Thank you for your efforts to maintain compliance with the federal regulations for the protection of human subjects. Please let me know if you have any questions.

DO NOT REPLY TO THIS EMAIL. IF YOU WISH TO CONTACT US, PLEASE SEND AN EMAIL MESSAGE TO cayuseirb@csuohio.edu.

Sincerely,

Mary Jane Karpinski
IRB Analyst
Cleveland State University
Sponsored Programs and Research Services
(216) 687-3624
m.karpinski2@csuohio.edu

APPENDIX C

Cleveland State University

engagedlearning

College of Education and Human Services

Department of Health and Human Performance

RAMADAN RESEARCH STUDY

- **Are you 18 years old or older?**
- **Are you planning to fast the month of ramadan this year?**

We are looking for participants to take part in a research study for Abdullah Alwaleedi's Master's thesis under the supervision of Dr. Douglas Wajda at Cleveland State University. The purpose of this study is to observe the potential changes in physical activity and sleep patterns during the month of Ramadan.

If you are Interested in participation in this study, please contact Abdullah at abdullah.alwaleedi@gmail.com or (202)702-9808

APPENDIX D

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

SHORT LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

APPENDIX E

General Instructions

What is a Sleep Diary? A sleep diary is designed to gather information about your daily sleep pattern.
How often and when do I fill out the sleep diary? It is necessary for you to complete your sleep diary every day. If

possible, the sleep diary should be completed within one hour of getting out of bed in the morning.

What should I do if I miss a day? If you forget to fill in the diary or are unable to finish it, leave the diary blank for that day.

What if something unusual affects my sleep or how I feel in the daytime? If your sleep or daytime functioning is affected by some unusual event (such as an illness, or an emergency) you may make brief notes on your diary.

What do the words "bed" and "day" mean on the diary? This diary can be used for people who are awake or asleep at unusual times. In the sleep diary, the word "day" is the time when you choose or are required to be awake. The term "bed" means the place where you usually sleep.

Will answering these questions about my sleep keep me awake? This is not usually a problem. You should not worry about giving exact times, and you should not watch the clock. Just give your best estimate.

Item Instructions

Use the guide below to clarify what is being asked for each item of the Sleep Diary. *Date:* Write the date of the morning you are filling out the diary.

1. What time did you get into bed? Write the time that you got into bed. This may not be the time that you began "trying" to fall asleep.

2. What time did you try to go to sleep? Record the time that you began "trying" to fall asleep.

3. How long did it take you to fall asleep? Beginning at the time you wrote in question 2, how long did it take you to fall asleep.

4. How many times did you wake up, not counting your final awakening? How many times did you wake up between the time you first fell asleep and your final awakening?

5. In total, how long did these awakenings last? What was the total time you were awake between the time you first fell asleep and your final awakening. For example, if you woke 3 times for 20 minutes, 35 minutes, and 15 minutes, add them all up (20+35+15= 70 min or 1 hr and 10 min).

6. What time was your final awakening? Record the last time you woke up in the morning.

7. What time did you get out of bed for the day? What time did you get out of bed with no further attempt at sleeping? This may be different from your final awakening time (e.g. you may have woken up at 6:35 a.m. but did not get out of bed to start your day until 7:20 a.m.)

8. How would you rate the quality of your sleep? "Sleep Quality" is your sense of whether your sleep was good or poor.

9. *Comments* If you have anything that you would like to say that is relevant to your sleep feel free to write it here.

Figure 1 continues on the following page

Consensus Sleep Diary-Core ID/Name:______________________________

	Sample							
Today's date	4/5/11							
1. What time did you get into bed?	10:15 p.m							
2. What time did you try to go to sleep?	11:30 p.m							
3. How long did it take you to fall asleep?	55 min.							
4. How many times did you wake up, not counting your final awakening?	3 times							
5. In total, how long did these awakenings last?	1 hour 10 min.							
6. What time was your final awakening?	6:35 a.m.							
7. What time did you get out of bed for the day?	7:20 a.m							
8. How would you rate the quality of your sleep?	☐ Very poor ☑ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good	☐ Very poor ☐ Poor ☐ Fair ☐ Good ☐ Very good
9. Comments (if applicable)	I have a cold							

Figure 1 *(continued)*—Sleep Diary Instructions: Core

APPENDIX F

INFORMED CONSENT

Changes in physical activity and sleep patterns during Ramadan

This study is being completed by students and faculty from Cleveland State University. The project is being conducted by Dr. Douglas Wajda, Dr. Kenneth Sparks, and graduate student Abdullah Alwaleedi.

Before you decide if you would like to participate in this study, there are a few things you need to understand about the study. Please read this document carefully. Ask any questions you may have.

The purpose of this study is to track the physical activity and sleep patterns among healthy Muslims during the month of Ramadan. We are interested in observing the level of physical activity and sleep patterns during the month of Ramadan. The study is observational and you are not required to change your observance of Ramadan in any way.

Procedures:

You will be receiving two surveys in an envelope to complete in three different times. You will be given this envelope a week prior to Ramadan, last week of Ramadan, and a month following the month of Ramadan.

The envelope includes a sleep diary and a physical activity questionnaire. The sleep diary consists of questions related to your sleep patterns. You will fill out these questions daily of a total of seven days.

The physical activity questionnaire is designed to assess your physical activity level for a week period. You will fill out this survey once only at each time. Each survey will be explained to you.

Associated Risks and Benefits:

The risks associated with this study are expected to be minimal. It is important to note that the study is observational so you are not being asked to change anything about your daily life or current practices.

You will not directly benefit from this study. However, your values will be interpreted for you in relation to outlined clinical guidelines and implications for your health.

To protect your privacy, your name will not be used in any document of the project. A participant number will be assigned to you. Data collected may be used for a scientific purpose with your privacy maintained. The investigator will be the only witnesses of the information being presented. Your name will be replaced by pseudonyms when data are disseminated.

Participation and Freedom of Consent

I understand that participation in this project is voluntary. I understand I have the right to withdraw at any time without consequences. I understand that if I have any questions about my rights as a participant, I can contact Cleveland State University's Institutional Review Board at (sprs@csuohio.edu).

The purpose and risks of the study have been explained to me. If I have any questions about the procedures I can contact Dr. Wajda (d.a.wajda@csuohio.edu), Dr. Sparks (k.sparks@csuohio.edu), or Mr. Alwaleedi (a.alwaleedi@vikes.csuohio.edu).

I have read the consent form, or it has been read to me, and I understand it. I acknowledge that I am at least 18 years old and agree to participate in this study. I have been given a copy of this consent form.

You will be given a copy of the informed consent form for your records.

Name (please print)	Signature	Date

Witness (please print)	Signature	Date