STUDY ON CHRONO-NUTRITION PROFILE OF ROTATIONAL SHIFT WORKERS AND REGULAR SHIFT WORKERS

APRIL, 2025

ANJALI SOLANKI

P.G DIPLOMA

(APPLIED NUTRITION)

STUDY ON CHRONO-NUTRITION PROFILE OF ROTATIONAL SHIFT WORKERS AND REGULAR SHIFT WORKERS

A Dissertation submitted in partial fulfillment of the requirement for the degree of
Master of Science
(Family and Community Sciences)
(Dietetics)

BY

ANJALI SOLANKI

P.G. DIPLOMA

APPLIED NUTRITION

Department of Foods and Nutrition
Faculty of Family and Community Sciences
The Maharaja Sayajirao University of Baroda
Vadodara-390002, GUJARAT
April, 2025

CERTIFICATE

This is to certify that the research work presented in this thesis has been carried out independently by Ms. Anjali Solanki under the guidance of Dr. Suneeta Chandorkar in pursuit of the Degree of Master of Science (Family and Community Sciences) with major in Foods and Nutrition (Dietetics), and this is her original work.

I/c Head

Dr. Suneeta Chandorkar

Guide

Department of Foods and Nutrition,
Faculty of Family and Community Sciences,
The Maharaja Sayajirao University of Baroda,
Vadodara

ACKNOWLEDGEMENT

I would like to begin by expressing my profound gratitude to my guide, Dr. Suneeta Chandorkar, whose unwavering support, wisdom, and mentorship have been the cornerstone of this thesis. Her insightful feedback, patient guidance, and constant encouragement not only helped me navigate the research process but also inspired me to grow both personally and professionally. I consider myself truly fortunate to have had the opportunity to work under her guidance. I sincerely thank the Dean, the Head of the Department, and all my respected teachers for creating a supportive academic environment and imparting knowledge that has been foundational to this journey.

A heartfelt thank you to the wonderful team who supported my data collection efforts. I am sincerely grateful to Mr. Sedhu Madhavan, Mr. Anit Nair, Mrs. Divya Nair, Ms. Surya Sunilkumar and Mr. Dhaval Bhai for their incredible cooperation, logistical support, and constant encouragement throughout the fieldwork. Your commitment, openness, and time made the data collection process seamless and efficient. I am incredibly grateful to Bhavya Pande and Himanshi Pandey, the PhD scholars, for their kind support, valuable insights, and encouragement during key stages of my work. A special note of thanks to Surabhi Parekh, whose unwavering support, insightful guidance, and continuous encouragement were instrumental throughout my research journey.

To my pillars of strength—my parents, Mrs. Anita Solanki, and Mr. Arjun Singh Solanki—thank you for your unconditional love, sacrifices, and endless belief in my abilities. Your encouragement through every challenge and celebration has meant the world to me.To my friends, Tamanna Makwana, Abhishek Jain, Priyanka Kale, and Rosemary, thank you for being my constant source of strength.

With Warm Regards,

Anjali Solanki

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

SCN – Suprachiasmatic Nucleus.

TRE - Time-restricted Eating

WHO - World Health Organization.

IARC - International Agency for Research on Cancer

CPQ - The Chrono-nutrition Profile – Questionnaire

CPD - Chrono-nutrition Profile – Diary

SJL - Social jetlag

MetS - Metabolic Syndrome

GI - Low Glycemic Index.

CHD - Coronary Heart Disease.

IECHR - Institutional Ethical Committee for Human Research

BMI - Body Mass Index

MCTQShift - Munich Chronotype Questionnaire for Shift Workers

SO – Sleep Onset

SD – Sleep Duration

SDebt – Sleep Debt

MST – Mid-Sleep Time

M, E, N – Morning Shift, Evening Shift, Night Shift

ABSTRACT

The growing prevalence of shift work in industrial sectors has brought increased attention to its physiological, psychological, and behavioral impacts. Among these, chrono-nutrition—the study of how meal timing interacts with the circadian rhythm—has emerged as a crucial aspect of health research. Traditional dietary guidelines emphasize the type and quantity of food consumed, but chrono-nutrition shifts focus toward when meals are consumed, recognizing that alignment between eating patterns and the body's internal clock is essential for metabolic regulation. Disruption of these rhythms, common among shift workers, can impair glucose metabolism, increase adiposity, and raise the risk of chronic diseases. Despite global studies on this topic, research on Indian industrial shift workers, particularly regarding their chrono-nutrition profile, remains scarce. This study aimed to assess and compare the chrono-nutrition profile of rotational and regular shift workers. Specific objectives included examining differences in chronotype, dietary intake, meal timing behaviours, body composition, physical activity, stress levels, and sleep quality. The study also explored associations between chrono-nutrition and other lifestyle indicators such as screen time, sitting time, and work environment.

A cross-sectional study was conducted among 200 male industrial workers in Vadodara, Gujarat, comprising 100 rotational shift workers and 100 regular shift workers. Participants were purposively selected based on their employment in shift-based roles for at least one year. Ethical approval was obtained, and informed consent was secured prior to data collection. A multi-dimensional assessment approach was employed using validated tools and instruments. Chronotype was assessed using the Horne and Ostberg Morningness-Eveningness Questionnaire and the MCTQShift. Dietary intake was recorded using a three-day 24-hour dietary recall (covering work and non-work days) and analyzed using Nutrical software. Anthropometric and body composition measurements, including BMI, body fat, visceral fat, and skeletal muscle, were obtained using Omron Body Composition Monitor. Physical activity was evaluated using the Global Physical Activity Questionnaire (GPAQ), stress using the Perceived Stress Scale (PSS), and sleep quality via the Pittsburgh Sleep Quality Index (PSQI). The chrono-nutrition profile was scored using a six-indicator behavior profiling tool

developed by Engwall, encompassing eating window, breakfast skipping, evening latency, evening eating, night eating, and largest meal timing. Additional parameters included screen time and sitting duration.

Rotational shift workers were predominantly younger, while regular shift workers included more participants above 40 years. Rotational workers showed higher levels of sedentary behavior and higher adiposity. Dietary analysis revealed that meal skipping, late-night eating, and reliance on canteen-based food were more common among rotational shift workers. Regular shift workers had greater access to home-prepared meals and reported more structured eating habits. The chronotype analysis indicated a dominance of morning-type individuals in both groups, though rotational shift workers demonstrated greater chrono-disruption due to their irregular schedules. Sleep quality was poorer in rotational shift workers, with 78% classified as having poor sleep compared to 56% in regular shift workers. Stress levels were moderate across the sample, but high stress was more prevalent in the regular shift group. Sleep debt and social jetlag were highest among night shift workers, reflecting significant circadian misalignment. Chrono-nutrition scores showed that rotational shift workers had a higher prevalence of poor eating behaviors in terms of timing and regularity.

Statistical analysis showed significant associations between sleep quality, stress, chronotype, and chrono-nutrition behavior. Among rotational shift workers, stress and sleep quality were closely linked. Physical activity levels were higher in this group, yet their sedentary time still placed them in medium risk categories. Among regular shift workers, lower physical activity and higher screen time contributed to weight gain and metabolic risk. Chrono-disruption was found to be influenced by shift type, age, sleep duration on free days, and commuting time.

Significant associations were found between chronotype and dietary intake. Morning chronotypes in both shift types showed healthier eating behaviours, but these were more consistent in regular workers due to stable schedules. Similarly, chrono-nutrition profiles showed strong correlations with nutritional status; better-aligned eating habits were linked to healthier BMI, lower fat mass, and higher muscle mass, while misaligned patterns led to obesity and metabolic risk. Physical activity also exhibited a strong link—low activity was associated with misaligned eating behaviours, whereas moderate to high activity correlated with structured and healthier chrono-nutritional patterns.

The study concludes that both rotational and regular shift workers face distinct challenges concerning circadian alignment, dietary patterns, sleep quality, and stress. Rotational shift workers, despite being younger and more active, are at greater risk of chrono-disruption due to meal irregularities and poor sleep. Regular shift workers, although benefiting from more consistent schedules, are more sedentary and experience higher levels of stress and adiposity. These findings highlight the urgent need for workplace health interventions that address shift-specific risks. Recommendations include personalized shift scheduling based on chronotype, chrono-nutrition education, improved food availability during night shifts, sleep hygiene awareness, and promotion of physical activity. Overall, aligning work and meal schedules with the body's natural rhythms may significantly enhance health outcomes and productivity among industrial shift workers.

INTRODUCTION

1. Background of the Study

1.1 Chrono-Nutrition and the Role of the Circadian Clock

Nutrition plays a critical role in human health, influencing metabolism, energy balance, and disease prevention. Traditional dietary guidelines primarily focus on *what* and *how much* we eat, but recent research highlights the importance of *when* we eat in relation to our biological rhythms (Almoosawi et al., 2019). Chrono-nutrition is an emerging field that examines the relationship between meal timing, food composition, and circadian rhythms, emphasizing that when food is consumed is just as important as what is consumed (Regmi & Heilbronn, 2020). The circadian rhythm is an internal biological clock that governs various physiological processes, including digestion, hormone secretion, sleep-wake cycles, and metabolism (Patke et al., 2020).

The master circadian clock, housed within the suprachiasmatic nucleus (SCN) of the hypothalamus, plays a crucial role in regulating the body's daily physiological rhythms. Acting as the central timekeeper, it synchronizes various biological functions, including hormone secretion, sleep-wake cycles, and metabolism. However, the SCN does not work alone—it communicates with peripheral clocks present in key metabolic organs such as the liver, pancreas, muscles, and gut, ensuring coordinated metabolic processes throughout the body (Cermakian & Boivin, 2020).

While light exposure is the primary zeitgeber (time cue) that resets the SCN and aligns the central clock with the external environment, meal timing serves as a dominant regulator of peripheral metabolic clocks (Poggiogalle et al., 2018). Unlike the SCN, which is primarily influenced by the light-dark cycle, metabolic clocks in the liver, pancreas, and gut are highly responsive to food intake patterns. The timing of meals can either reinforce circadian synchronization or cause misalignment, leading to metabolic disturbances (Wehrens et al., 2017).

When food intake is misaligned with the body's natural circadian rhythm—such as consuming meals late at night, eating irregularly, or skipping breakfast—it disrupts metabolic homeostasis. This misalignment impairs insulin sensitivity, glucose regulation, lipid metabolism, and energy balance, significantly increasing the risk of obesity, type 2 diabetes, and cardiovascular diseases (Wehrens et al., 2017). Studies suggest that eating during the body's biological night, when melatonin secretion is high and insulin function is reduced, can promote fat storage, elevate blood sugar levels, and heighten inflammation, contributing to long-term metabolic disorders (Poggiogalle et al., 2018).

Thus, meal timing is not just a dietary habit—it serves as a critical factor in maintaining circadian alignment and metabolic health. Research continues to explore how strategic meal scheduling, such as time-restricted eating (TRE) or aligning meals with natural circadian phases, can enhance metabolic efficiency and prevent chronic diseases (Cermakian & Boivin, 2020).

1.2 Mechanism of Chrono-Nutrition and Its Link to Circadian Disruption

Chrono-nutrition operates through several biological mechanisms that regulate energy metabolism, appetite, and metabolic efficiency. The primary mechanisms include:

a) Central and Peripheral Clocks in Metabolic Regulation

- The SCN acts as the master circadian clock, synchronizing peripheral clocks in metabolic organs (Cermakian & Boivin, 2020).

- Peripheral clocks in the liver, pancreas, and gastrointestinal tract regulate glucose homeostasis, insulin sensitivity, and fat metabolism (Wehrens et al., 2017).

- Disruptions in meal timing—such as eating at night—lead to glucose intolerance, insulin resistance, and weight gain (Patke et al., 2020).

b) Hormonal Regulation and Nutrient Metabolism

- Insulin sensitivity is highest in the morning and decreases throughout the day, making late-night eating more likely to cause higher blood sugar levels and fat accumulation (Jakubowicz et al., 2013).

- Leptin (satiety hormone) and ghrelin (hunger hormone) follow a circadian rhythm. Disrupting meal timing increases ghrelin secretion at night, leading to overeating and weight gain (Garaulet et al., 2013).

- Cortisol, the stress hormone, follows a diurnal pattern. Irregular eating schedules lead to prolonged cortisol release, promoting fat accumulation (James et al., 2017).

c) Energy Expenditure and Nutrient Absorption

- Energy expenditure is highest in the morning, meaning calories consumed earlier in the day are more efficiently metabolized than those eaten later (Wehrens et al., 2017).

- Studies suggest that people who consume more calories at breakfast rather than dinner experience better metabolic health (Jakubowicz et al., 2013).

1.3 Circadian Disruption and Its Consequences

Circadian disruption occurs when external factors such as shift work, late-night eating, and artificial light exposure interfere with the body's biological clock (Chellappa et al., 2021). This misalignment negatively affects hormonal balance, metabolism, and sleep quality (Roenneberg et al., 2019).

Some major consequences of circadian disruption include:

a) **Sleep Disturbances** – Disruptions in melatonin production result in poor sleep quality, chronic fatigue, and increased cardiovascular risk (Kecklund & Axelsson, 2016).

b) **Increased Stress Levels** – Chronic circadian misalignment raises cortisol levels, increasing the risk of hypertension, anxiety, and depression (James et al., 2017).

c) **Metabolic Disorders** – Circadian misalignment disrupts glucose metabolism and fat storage, increasing the risk of obesity and diabetes (Nagashima et al., 2014).

d) **Reduced Physical Activity** – Fatigue due to poor sleep and circadian misalignment results in low energy levels and a sedentary lifestyle, promoting weight gain (Bøggild & Knutsson, 1999).

1.4 Shift Work and Chrono-Disruption

Shift work refers to any work schedule that falls outside the conventional 9-to-5 framework, including evening, night, rotating, and split shifts. It is a key component of industries that require round-the-clock operations, such as healthcare, manufacturing, emergency services, transportation, and customer support (Costa, 2016). Over the years, shift work has gained prominence due to globalization, technological advancements, and the increasing demand for 24/7 services (Knutsson, 2003).

As businesses and economies evolve, the necessity for continuous operations has made shift work an essential part of the modern workforce.While shift work helps maintain productivity and efficiency, it also presents several challenges for workers, including health risks, work-life balance concerns, and decreased job satisfaction. Research has shown that irregular working hours can lead to sleep disturbances, fatigue, and long-term health issues such as cardiovascular diseases and mental health disorders (Kecklund & Axelsson, 2016).

Consequences of chrono-disruption in shift workers include:

- Higher risk of obesity and metabolic syndrome due to late-night eating and disrupted hunger signals (Jakubowicz et al., 2013).
- Increased prevalence of sleep disorders, as irregular work hours interfere with melatonin secretion (Wehrens et al., 2017).
- Higher risk of cardiovascular diseases and certain cancers (IARC, 2010).

1.5 Shift Work as a Carcinogen (WHO Recognition)

The World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) classify shift work with circadian disruption as a probable human carcinogen (Group 2A) (Hansen, 2017). Long-term shift work has been associated with:

- Suppressed melatonin production, leading to impaired DNA repair and immune function.
- Higher oxidative stress, increasing the risk of cancer development (Chellappa et al., 2019).

1.6 Rationale for the Study

Shift work is becoming increasingly common in India, particularly in healthcare, industrial, and service sectors. In cities like Vadodara, Gujarat, many industries operate on rotational and night shift schedules to meet the demands of a 24-hour workforce.

However, limited research has been conducted on the chrono-nutrition patterns of industrial shift workers in India.

Past Research on Healthcare Professionals in India

- Several studies in India have focused on healthcare professionals, particularly doctors and nurses, and have reported that shift work is associated with poor metabolic health, obesity, and chronic illnesses (Kumar et al., 2021; Patel et al., 2020).
- However, research on industrial shift workers in India remains scarce, despite their unique work conditions and dietary habits.

Research Gaps and Study Justification

- Most studies on Indian shift workers focus on sleep disorders and occupational stress rather than chrono-nutrition.
- Existing global studies on shift work and chrono-nutrition may not directly apply to India due to differences in diet, work conditions, and lifestyle factors.
- There is little research on how shift schedules impact meal timing, metabolic health, and dietary intake in India's industrial sector.

The study aims to focus on the following objectives to fulfil the gap:

1.7 Objectives:-

Broad Objective:

- To study the Chrono-nutrition profile of Rotational and Regular Shift workers.

Specific Objectives:

- To identify the chronotype and Chrono-nutrition profile of rotational and regular shift workers.
- To assess the work environment of regular and rotational shift workers (regarding work hours, food availability and utilisation).
- To study the body composition, physical activity level, dietary intake, stress and sleep patterns of rotational and regular shift workers.
- To study the association of the chronotype and chrono-nutrition profile of shift workers (rotational shift worker and regular shift worker) with their dietary intake, body composition, physical activity level, stress and sleep pattern.

REVIEW OF LITERATURE

The present chapter includes a literature review under the following headings:

2.1 Circadian Rhythm and Circadian Clocks

2.2 Chrono-nutrition

2.3 Chrono-nutrition profile and Chronotype

2.4 Circadian Misalignment

2.5 Shift Work and Circadian Disruption

2.6 Concept of Social Jetlag and its intersection with Shift Work

2.7 Addressing Social Jetlag in Shift Workers Through Chrono-Nutrition

2.8 Association of Shift Work and Chrono-nutrition

2.9 Association of Shift Work and Chrono-nutrition and Overall Health

2.10 Association of Sleep and Chrono-nutrition in Shift Work

2.11 Association of Hormones and Chrono-nutrition in Shift Work

2.12 Association of Dietary Intake and Chrono-nutrition in Shift Work

2.13 Association of Body Composition and Chrono-nutrition in Shift Work

2.14 Association of Physical Activity and Chrono-nutrition in Shift Work

2.15 Association of Screen Time and Chrono-nutrition in Shift Work

2.16 Association of Mental Health and Chrono-nutrition in Shift Work

2.1 Circadian Rhythm and Circadian Clocks:

Circadian rhythms are endogenous near-24-hour oscillations in physiological processes that regulate various aspects of human biology, including sleep-wake cycles, metabolism, hormone secretion, and cellular proliferation (Han et al., 2021; Saeed et al., 2019). The suprachiasmatic nucleus (SCN) in the hypothalamus serves as the primary circadian pacemaker, maintaining rhythmicity through a complex transcription-translation feedback loop of core circadian clock genes (Saeed et al., 2019; Samanta, 2021). At the molecular level, the core clock in human cells consists of four main circadian proteins working in pairs: CLOCK-BMAL1 and PER-CRY heterodimers, which regulate each other's expression in a negative feedback loop (Gršković & Korać, 2023).

Interestingly, while the SCN acts as the central pacemaker, peripheral tissues also possess their circadian clocks that can be entrained by other stimuli, such as food intake, and can potentially uncouple from the SCN pacemaker (Consens, 2023). This discovery may provide new therapeutic options for circadian rhythm disorders. Additionally, recent research has revealed that clock proteins play a crucial role in the subnuclear reorganization of core clock genes, demonstrating how clocks function at the subcellular level (Xiao et al., 2021).In conclusion, circadian rhythms are ubiquitous and essential for maintaining normal physiological and behavioural processes. Disruption of these rhythms can lead to various health issues, including metabolic syndromes, cardiovascular problems, and cancer (Han et al., 2021; Samanta & Ali, 2022; Samanta, 2021).

2.2 Chrono-nutrition:

Chrono-nutrition, the circadian timing of food intake, has emerged as a significant factor in metabolic health and weight management. Research indicates that the timing of meals can impact obesity, type 2 diabetes, and cardiovascular disease (Johnston et al., 2016; Verde et al., 2024). The Chrono-nutrition Profile – Questionnaire (CP-Q) has been developed to assess six key components of chrono-nutrition: breakfast skipping, largest meal, evening eating, evening latency, night eating, and eating window (Veronda & Irish, 2022; Veronda et al., 2019). This tool has shown acceptable validity for use in diverse community samples, with moderate to strong correlations to measures of dietary intake and sleep (Veronda & Irish, 2022).

Interestingly, studies have revealed high inter-individual variability in chrono-nutrition preferences and eating misalignment, defined as the discrepancy between preferred and actual eating times (Veronda & Irish, 2020). This suggests that when individuals want to eat may differ from when they eat, which could have implications for developing personalized dietary interventions. Additionally, recent epidemiological studies have found associations between longer eating durations (>12h) and later meal timings with increased prevalence of abdominal obesity and elevated fasting glucose in adults (Cunha et al., 2023).

In conclusion, chrono-nutrition is a promising area of research with potential applications in improving metabolic health and weight management. While current studies suggest that chrono-nutrition-based interventions could reduce cardiovascular disease risk by improving weight control, hypertension, dyslipidaemia, and diabetes, more long-term and consistent studies are needed to fully understand its effects (Katsi et al., 2022). As the field evolves, tools like the CP-Q and CP-D (Chrono-nutrition Profile – Diary) may contribute to the development of targeted health behaviour interventions and research programs centred around chrono-nutrition (Veronda & Irish, 2022; Veronda et al., 2022).

2.3 Chrono-nutrition profile and Chronotype:

Chrono-nutrition, an emerging field in nutritional epidemiology, encompasses the timing, frequency, and regularity of eating behaviours. Recent research has revealed associations between chronotype (individual circadian preference) and dietary patterns, with potential implications for cardiometabolic health (Almoosawi et al., 2018).

Studies have found that morning chronotypes tend to have better adherence to healthy eating patterns like the Mediterranean diet compared to evening chronotypes (Naja et al., 2022; Yalcin & Ozturk, 2023).Morning chronotypes also show a higher intake of nutrients like potassium, fibre, and magnesium, particularly at breakfast and lunch, while evening chronotypes tend to have higher energy and nutrient intake at dinner (Nitta et al., 2023). Interestingly, evening chronotype has been linked to higher educational attainment, suggesting complex relationships between circadian rhythms and life outcomes (Lane et al., 2016; Lane et al., 2016).

In conclusion, chronotype appears to influence dietary patterns and nutrient intake timing, which may have implications for overall health. However, more research is needed to fully understand the interplay between chronotype, chrono-nutrition, and health outcomes, especially in diverse populations (Chong et al., 2022). The COVID-19 pandemic has also impacted circadian rhythms and eating patterns, highlighting the need for further investigation in this evolving field (Saidi et al., 2024; Uyar & Yildiran, 2022).

2.4 Circadian misalignment:

Circadian misalignment occurs when there is a mismatch between an individual's internal biological clock and their external environment or behaviours. This misalignment can result from various factors, including shift work, jet lag, or irregular sleep-wake patterns. Research has shown that circadian misalignment can have significant negative impacts on health, particularly to metabolic and cardiovascular functions (Baron & Reid, 2014; Shafer et al., 2023).

Studies have demonstrated that circadian misalignment can lead to impaired glucose tolerance and increased risk of diabetes. For instance, nighttime eating during simulated night work led to misalignment between central and peripheral circadian rhythms, resulting in glucose intolerance. Interestingly, restricting meals to daytime hours prevented this misalignment and its associated metabolic consequences (Chellappa et al., 2021). Additionally, circadian misalignment has been linked to alterations in blood pressure regulation, potentially increasing the risk of hypertension, especially in shift workers (Shafer et al., 2023).

In conclusion, circadian misalignment is a significant factor contributing to various health issues, including metabolic disorders, cardiovascular problems, and mental health conditions. Understanding the mechanisms behind circadian misalignment and its effects on the body can lead to the development of targeted interventions and preventive strategies. These may include optimizing meal timing, light therapy, and melatonin supplementation to mitigate the negative health consequences associated with circadian disruption (Huang et al., 2021; Shafer et al., 2023).

2.5 Shift Work and Circadian Disruption:-

2.5.1 Shift Work: An Overview :

Shift work encompasses employment schedules that extend beyond traditional daytime working hours, including evening, night, early morning, or rotating shifts (Kecklund & Axelsson, 2016). This work structure is vital in sectors that require continuous operations, such as healthcare, manufacturing, emergency services, aviation, and transportation (Knutsson, 2003). Approximately 20% of the workforce in industrialized countries is engaged in shift work, highlighting its significance in modern economies (Bøggild & Knutsson, 1999; Knauth, 2001).

2.5.2 Types of Shift Work:

- **Fixed Shifts:** Employees consistently work a specific shift (e.g., night or evening). While this allows for some adaptation, long-term night shifts have been associated with chronic circadian misalignment and increased risk of metabolic disorders (Boivin & Boudreau, 2014). Studies indicate that individuals on fixed night shifts report higher rates of chronic illnesses, such as cardiovascular diseases and gastrointestinal disorders (Knutsson, 2003; Sharma et al., 2018).

- **Rotating Shifts:** In this model, employees alternate between different shifts (e.g., morning to night). This disruption to the body's internal clock is particularly challenging. Studies show that individuals may take between 2 to 3 weeks to fully adjust to a new schedule, leading to increased fatigue and decreased alertness during shifts (Foster & Wulff, 2005). Research has noted that rotating shift workers have a higher risk of developing sleep-related disorders compared to those on fixed shifts (Bakker et al., 2014).

- **On-Call Shifts:** Workers remain available for unpredictable shifts with variable start times, leading to increased physiological stress and irregular sleep patterns (Garde et al., 2019). The unpredictability and constant availability required in on-call jobs can contribute to a significant psychological burden, resulting in elevated stress levels and a higher incidence of burnout (Demerouti et al., 2009).

2.5.3 Circadian Disruption: Desynchronization of Biological Clocks –

Shift work severely disrupts the synchronization between the internal biological clock (regulated by the suprachiasmatic nucleus in the hypothalamus) and external time cues, such as light-dark cycles (Foster & Kreitzman, 2014). This misalignment results in poor sleep efficiency, metabolic disturbances, and impaired cognitive function (Wright et al., 2013). According to a systematic review, shift workers exhibit a 30% reduction in sleep quality compared to their non-shift-working counterparts (Hirshkowitz et al., 2015).

2.5.3.1 Hormonal Impact:

- **Melatonin Suppression**: Exposure to artificial light during night shifts inhibits melatonin secretion, which is crucial for regulating sleep-wake cycles, leading to reduced sleep quality and increased oxidative stress (Chellappa et al., 2019). Studies have shown that shift workers experience significantly lower melatonin levels, contributing to sleep disorders and increased risk for chronic diseases (Arendt, 2010; Tsai et al., 2020).

- **Cortisol Dysregulation:** Cortisol levels, which typically follow a diurnal pattern (high in the morning, low at night), may become dysregulated due to shift work. This alteration has negative impacts on metabolism and immune function (Hansen, 2017). Elevated cortisol levels in shift workers are linked to increased risk of metabolic syndrome, hypertension, and cardiovascular diseases (Knutsson et al., 2014).
- **Insulin and Ghrelin Changes:** Irregular meal timing and nighttime eating disrupt insulin sensitivity, increasing the risk of obesity and type 2 diabetes (Qian & Scheer, 2016). A meta-analysis demonstrated that shift workers have a 40% increased risk of developing insulin resistance compared to daytime workers, especially among those who engage in night shifts (Pan et al., 2011; Zimmet et al., 2016).

2.6 Concept of Social Jetlag and its intersection with Shift Work in Chrono-nutrition:

Social jetlag (SJL) is characterized by the misalignment between an individual's biological clock and their socially imposed schedules (e.g., work, school), often quantified by the difference in sleep midpoint between workdays and free days (Wittmann et al., 2006). Studies indicate that over 80% of adults experience some degree of social jetlag, with shift workers disproportionately affected (Roenneberg et al., 2012). In the studying/working population of industrialized countries, SJL is a highly prevalent phenomenon that many people experience for the whole study/work career [6,17,49]. It has been estimated that 70% of students and workers experience at least one hour of SJL, while almost half of them experience two hours or more. The high prevalence of SJL underscores the need for effective strategies to mitigate its effects on health, as chronic SJL has been linked to obesity, mood disorders, and cardiovascular issues (Roenneberg et al., 2019).

2.6.1 Mechanism: Sleep Timing Mismatch:

SJL resembles traditional jetlag, where the body's internal clock is forcibly shifted due to external obligations. However, unlike jetlag caused by time zone travel, social jetlag often arises from the constant shifts between natural sleep schedules (on free days) and enforced sleep schedules (on workdays)(Korman et al., 2020). Chronic social jetlag contributes to sleep deprivation, with studies showing that individuals with SJL report an average of 1.5 hours less sleep on workdays compared to their self-identified sleep duration (Levandovski et al., 2011).

2.6.2. Impact on Circadian Rhythms:

2.6.2.1. Inconsistent Sleep Duration: SJL leads to fragmented, shorter sleep on workdays and extended sleep durations on free days, negatively affecting cognitive performance and metabolic health (Levandovski et al., 2011). Individuals with significant SJL show poorer cognitive flexibility and decision-making abilities (Killgore, 2010). The effects of SJL on sleep quality have also been investigated in shift workers. Due to their working schedule, all shift workers have to periodically re-adjust their wake-up and bedtimes to be able to attend morning, evening or night shifts. As these shifts are usually assigned regardless of the individual's chronotype, it is no surprise that shift workers can experience up to three hours of SJL. Previous studies revealed that shift workers that experience SJL are also characterized by short sleep duration and low sleep quality (Juda, Vetter, & Roenneberg, 2013;Vetter et al., 2015).

2.6.2.2. Delayed Sleep Phase: A common manifestation of JSL is delayed sleep onset, where many shift workers find it challenging to fall asleep promptly before an early shift, compounding chronic sleep deprivation (Vetter et al., 2018). This delay can exacerbate fatigue and hinder alertness during shifts, significantly impacting performance and safety. In case of poor quality, sleep might exert a lower restorative capacity that could explain why people who experience SJL tend to be less alert, more fatigued, less prompt to wake up in the morning, and perform worse in academia or the workplace than those who do not experience SJL Haraszti et al., 2014; Fárková et al., 2021).

2.6.3. Intersection of Shift Work and Social Jetlag:

2.6.3.1. Exacerbation of Circadian Misalignment

Rotating and Night Shift Workers Experience Severe Social Jetlag:

Research shows that night shift workers average around 3 hours of social jetlag, which contributes to metabolic and psychological health complications (Wittmann et al., 2017). The constant adaptation required for rotating shifts prevents significant biological acclimatization to a given schedule, resulting in increased fatigue and decreased cognitive functioning (Foster & Wulff, 2005).

2.6.3.2. Health Implications:

2.6.3.2.1. Metabolic Dysfunction –

- **Increased Metabolic Syndrome Risk:** Shift work, defined as work occurring outside typical daytime working hours, is associated with an increased risk for metabolic syndrome (MetS) due to several biological and environmental changes. The MetS refers to the clustering of several known cardiovascular risk factors, including insulin resistance, obesity, dyslipidaemia, and hypertension. Shift workers exhibited more than a twofold increase in the chance of developing MetS in comparison with day workers (Sooriyaarachchi et al., 2022).

- **Increased Cardiometabolic Risk:** It was found that evening chronotype was related to higher triglycerides and lower HDL cholesterol, greater social jetlag associated positively with triglycerides, fasting insulin, insulin resistance, waist circumference, and BMI, and negatively with HDL-cholesterol. Sleep is an important modulator of hormonal secretion, glucose regulation, and cardiovascular function, and there is a negative relationship between sleep duration and degree of metabolic syndrome (Iftikhar et al., 2015; Syauqy et al., 2019).

- **Increased Risk of Obesity:** A comprehensive meta-analysis found that shift workers are 29% more likely to develop obesity than non-shift workers, attributed to irregular eating patterns and impaired energy expenditure (Gan et al., 2015). In the cross-sectional study among the components of the metabolic syndrome, an elevated risk of visceral obesity was found in men permanent night workers (Bayon et al., 2022). This finding is consistent with a recent meta-analysis, which found that shift workers had a higher frequency of abdominal obesity than other obesity types and permanent night workers demonstrated a 29% higher risk of central obesity than rotating shift workers (Sun et al., 2018).

- **Type 2 Diabetes Risk:** Research indicates that night shift workers have a 40% higher risk of developing type 2 diabetes compared to their day-working counterparts due to insulin resistance and altered glucose metabolism (Pan et al., 2011; Wang et al., 2016).The strongest evidence linking circadian disruption and type 2 diabetes derives from epidemiological studies which show that shift workers are at increased risk of developing this condition (Panet al, 2011; Kroenke et al., 2006).In a sample of 2860 industry workers followed for 8 years, Morikawa et al., (2005) found the incidence of diabetes to be 4.41 per 1000 people/year. The relative risk of diabetes was higher in subjects who worked consecutive night shifts than in those with administrative positions (relative risk: 2.01 after adjusting for all potential confounding factors). The study suggested that shift work is a risk factor for the development of diabetes. A study performed by Pan et al.,(2011) compared the association between rotating vs. fixed shifts and type 2 diabetes in 177,000 nurses aged 25–67 years. The risk of type 2 diabetes in participants exposed to rotating shift work for 1–2 years was 5 %. This value increased to 20 % after 3–9 years of rotating shift work, 40 % after 10–19 years, and almost 60 % after 20 years of rotating shifts.

2.6.3.2.2. Mental Health Consequences –

- **Chronotype and its relevance to Mental Health:** Eveningness appears to be a risk factor for depressive symptoms and the onset of a depressive disorder among young people. The relationship between Eveningness and depression and its symptoms was confirmed by recent research, which confirmed these links and demonstrated a difference in chronotype between depressed and non-depressed individuals. They found that an individual's chronotype is related to their depressive symptomatology, Eveningness being significantly associated with more severe symptoms. Mood depressive disorders appeared to be more evening-oriented than other depressive disorders.(Kivelä, L et. al.,2018).: Evening chronotype and SJL were associated with obesity and unfavourable metabolic parameters of glucose and lipid metabolism (Zhang et al., 2022).

- **Higher Stress and Anxiety:** Shift workers suffering from social jetlag report elevated cortisol levels and increased perceptions of stress, resulting in susceptibility to mood disorders (Knutson et al., 2014). The chronic stress associated with irregular sleep and wakefulness can lead to anxiety, depression, and burnout (Demerouti et al., 2009).

- **Cognitive Decline:** Disruptions in sleep patterns and internal clock misalignment contribute to reduced cognitive flexibility, diminished decision-making abilities, and memory deficits, impacting occupational performance and personal life (Killgore, 2010).

2.6.3.2.3. Sleep Disorders-

- **Higher Rates of Insomnia:** Chronic exposure to shift work is associated with significantly higher incidences of insomnia and excessive daytime sleepiness (Akerstedt et al., 2009). Consequently, shift workers may experience difficulties in staying alert, underscoring the critical importance of optimizing sleep hygiene and management strategies.

2.7. Addressing Social Jetlag in Shift Workers Through Chrono-Nutrition:-

2.7.1. Strategies to Minimize Social Jetlag:-

- **Consistent Meal Timing:** Establishing regular meal schedules is associated with reinforcing circadian alignment, promoting metabolic health (Leone et al., 2020). Eating meals simultaneously each day, particularly when aligned with natural daylight cycles, can help reduce metabolic disruptions related to shift work.

- **Bright Light Exposure:** Controlled exposure to bright light can assist shift workers in realigning their circadian rhythms and improving sleep efficiency. Research indicates that light therapy can enhance alertness and mood among shift workers, promoting better productivity (Dashti et al., 2021).

2.7.2. Chrono-Nutrition Approaches:

- **Time-Restricted Eating (TRE)**

  Restricting food intake to a specific time window (e.g., 8-10 hour periods) has been shown to:

  Improve glucose metabolism and insulin sensitivity, protecting against type 2 diabetes (Sutton et al., 2018). Assist in preventing weight gain and metabolic dysfunction among shift workers, leading to notable health improvements (Gabel et al., 2019).
- **Balanced Meals with Low-Glycaemic-Index Foods:**

  Incorporating low glycaemic index (GI) foods helps stabilize blood glucose levels and mitigate metabolic fluctuations associated with shift work (Patterson & Sears, 2020). Recent studies support the correlation between low GI diets and improved cardiometabolic health among shift workers (Richard et al., 2023).
- **Healthy Snacking Options:**

  Protein-rich and fiber-dense snacks (e.g., nuts, Greek yogurt) help maintain satiety and support energy levels, thereby diminishing the likelihood of unhealthy eating patterns during shifts (Morris et al., 2022). Studies have suggested that healthy snacking is associated with reduced cravings for high-calorie foods among shift workers (Wang et al., 2022).

2.8. Association of Shift Work and Chrono-nutrition:

Shift work has been associated with various dietary patterns and nutritional behaviors that can impact chrono-nutrition. Studies have shown that shift workers, particularly those working night shifts, tend to have irregular eating patterns and altered meal timing compared to day workers (Assis et al., 2003; Nagashima et al., 2014; Torre et al., 2020).

Shift workers often consume more meals at night, skip breakfast more frequently, and have a higher intake of snacks and caffeinated beverages (Nagashima et al., 2014; Pepłońska et al., 2019). They also tend to have lower consumption of fruits and vegetables, and higher intake of saturated fats, especially among older female shift workers (Hemiö et al., 2015). The timing of food intake is significantly affected by shift schedules, with split night shifts and recovery days after night shifts showing the most impact on energy distribution and food quality (Torre et al., 2020).

Interestingly, while shift work affects meal timing and food choices, some studies found no significant difference in total daily energy intake between different shifts (Assis et al., 2003; Torre et al., 2020). However, the circadian distribution of nutrient intake varied considerably. These findings highlight the importance of considering not just what shift workers eat, but when they eat, aligning with the principles of chrono-nutrition. The disruption of circadian rhythms and altered eating patterns associated with shift work may contribute to the increased risk of chronic diseases observed in this population (Pot, 2017; Takahashi & Tahara, 2022). Therefore, incorporating chrono-nutrition principles into dietary recommendations for shift workers could be a valuable strategy for improving their overall health and mitigating the negative impacts of their work schedules.

2.9. Association of Shift Work and Chrono-Nutrition with Overall Health:-

Shift work, particularly night and rotational shifts, significantly impacts chrono-nutrition and overall health. Studies have shown that these work schedules disrupt circadian rhythms, leading to various metabolic and health issues. Rotational shift work has been associated with impaired glucose metabolism. A study found that during night shifts, postprandial glycemic excursion was higher, and beta cell responsivity to glucose was decreased compared to day shifts (Sharma et al., 2017). This disruption in glucose metabolism may contribute to an increased risk of obesity and type 2 diabetes among shift workers. Additionally, shift work affects dietary habits, meal timing, and frequency, which can further exacerbate metabolic disorders such as hypertension, dyslipidemia, and abdominal obesity (Azmi et al., 2020). Interestingly, the impact of shift work on health may persist even after cessation. A large-scale study of nurses found that a longer duration of rotating night shift work was associated with a higher risk of coronary heart disease (CHD), with the risk decreasing after quitting shift work (Vetter et al., 2016). Similarly, another study linked rotating night shift work to an increased risk of ischemic stroke, particularly for those with 15 or more years of such work (Brown et al., 2009).

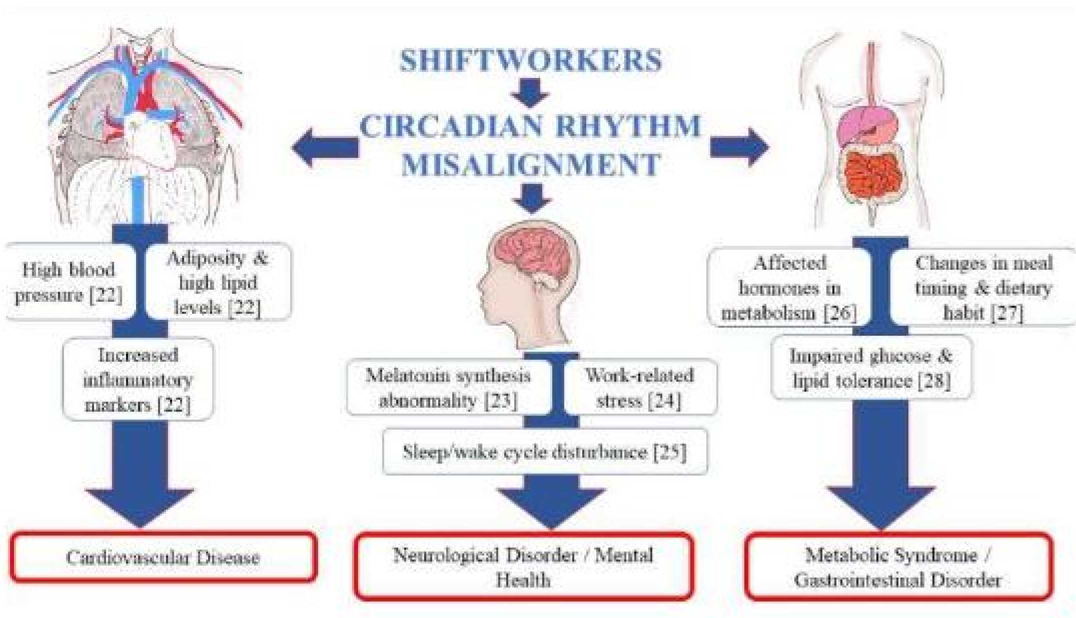

Fig. 2.1 Schematic diagram of the effect of circadian rhythm disruption on different body systems (Source: Mohd Azmi et al., 2020)

This figure illustrates the consequences of circadian rhythm misalignment in shift workers and its impact on various physiological systems:

- Cardiovascular System: Misalignment leads to increased inflammatory markers, high blood pressure, adiposity, and elevated lipid levels, contributing to cardiovascular disease.

- Neurological and Mental Health: Disturbances in melatonin synthesis, work-related stress, and disrupted sleep-wake cycles can result in neurological disorders and mental health issues.

- Metabolism and Digestion: Altered hormone regulation, disrupted meal timing, and poor dietary habits impair glucose and lipid metabolism, increasing risk of metabolic syndrome and gastrointestinal disorders.

In conclusion, night and rotational shift work significantly affect chrononutrition and health by disrupting circadian rhythms, altering glucose metabolism, and increasing the risk of various chronic diseases. These effects can persist even after shift work cessation, highlighting the importance of developing strategies to mitigate the negative impacts on workers' health and well-being.

2.10. Association of Sleep and Chrono-nutrition in Shift work:-

Shift work disrupts circadian rhythms and has significant impacts on sleep patterns and dietary habits, which can lead to various health issues. Studies have shown that shift workers, particularly those working night shifts, experience poor sleep quality and are more likely to have evening chronotypes (Ulusoy et al., 2021). This disruption in sleep patterns is associated with increased depressive symptoms, with part of this relationship mediated by short sleep duration during both weekdays and weekends (Frazier, 2023). Chrono-nutrition, which examines the relationship between meal timing and health, plays a crucial role in understanding the effects of shift work on health outcomes.

Shift workers tend to have higher daily energy intake and lower total daily energy expenditure (Ulusoy et al., 2021). On night shifts, there is a decrease in the consumption of fiber-rich foods and an increase in fats, sweets, and cereals. Additionally, shift work is associated with irregular eating patterns, including breakfast skipping and late-night eating, which are independent risk factors for diabetes and cardiovascular diseases (Takahashi & Tahara, 2022).

Sleep, chrono-nutrition, and shift work interplay is complex and multifaceted. Circadian disruption caused by shift work can lead to increased cardiometabolic risk, mediated by attenuated melatonin and cortisol production (Golding et al., 2022). Furthermore, poor sleep quality in shift workers is strongly associated with reduced cognitive performance (Vijaykumar et al., 2017). To mitigate these negative health consequences, it is crucial to consider chrono-nutrition principles, such as encouraging adequate water intake and healthy food choices during night shifts (Ulusoy et al., 2021), and to explore the potential of time-restricted feeding and personalized chrono-nutrition approaches (Takahashi & Tahara, 2022) for improving the health and well-being of shift workers.

2.11. Association of Hormones and Chrono-nutrition in Shift work:-

Night shift work is associated with significant disruptions in hormonal patterns and circadian rhythms, which can have profound effects on metabolism and nutrition: Shift workers exhibit altered secretion patterns of key hormones involved in appetite regulation and metabolism. Night workers show a blunted post-meal suppression of ghrelin and a blunted rise in xenin compared to day workers, which may contribute to increased appetite and energy intake (Schiavo-Cardozo et al., 2013). Additionally, night shift work is associated with changes in the timing and total production of melatonin and sex hormones like androgens and progestogens (Harding et al., 2021). Interestingly, the effects of shift work on hormonal patterns appear to be modulated by chronotype. Among day shift workers, morning chronotypes had melatonin rhythms with greater mean levels, larger peaks, and earlier peak onset compared to evening chronotypes. However, this pattern was reversed among rotating shift workers on night shifts, suggesting a complex interaction between shift work and individual circadian preferences (Razavi et al., 2019).

The hormonal disruptions associated with shift work have significant implications for metabolic health. Night shift workers show higher proportions of metabolic syndrome, insulin resistance, and unfavorable changes in adipokine levels compared to day workers (Ravibabu et al., 2021). These metabolic disturbances are likely mediated by alterations in melatonin secretion, which can impact DNA methylation in circadian genes (Ritonja et al., 2021; Ritonja et al., 2022). Overall, the evidence suggests that shift work, particularly night shifts, profoundly affects hormonal balance and chrono-nutrition, potentially contributing to adverse health outcomes in this population.

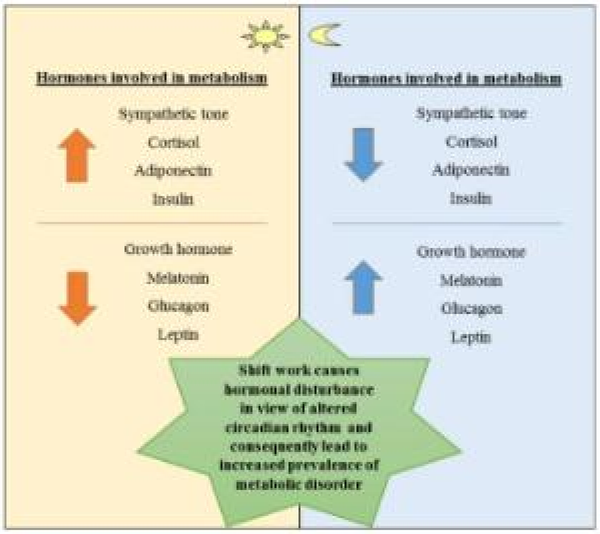

Fig. 2.2 Schematic diagram showing the effect of different hormones based on circadian rhythm (Source: Bass & Takahashi, 2010)

Figure 2.2 illustrates the circadian regulation of key metabolic hormones and how their levels vary between day and night:

- During the daytime, hormones like cortisol, adiponectin, insulin, and sympathetic tone increase, supporting alertness and metabolic activity.
- At night, there's a rise in melatonin, growth hormone, glucagon, and leptin, promoting rest, recovery, and energy regulation.

The central message is that shift work disrupts these natural hormonal rhythms, leading to metabolic imbalances and an increased risk of metabolic disorders.

2.12. Association of Dietary Intake with Chrono-nutrition in Shift work:

Shift work has been associated with changes in dietary intake quality and quantity, as well as disruptions to chrono-nutrition patterns. Studies have found that shift workers, particularly those working night shifts, tend to have poorer diet quality compared to day workers (Bonnell et al., 2017; Nakamura et al., 2018). Shift workers were found to have higher total energy intake but lower intakes of important nutrients like dietary fiber, vitamins, and minerals (Nakamura et al., 2018). They also reported consuming more discretionary foods and having limited availability of healthy food choices during night shifts (Bonnell et al., 2017).

Interestingly, while overall 24-hour energy intake may not differ significantly between day and night shifts, the energy density of the diet tends to be higher during night shifts (Bonnell et al., 2017). This suggests shift workers may be consuming more energy-dense foods at night.Additionally, shift work disrupts normal meal timing and regularity. Night shift workers were more likely to eat dinner at irregular times, skip breakfast, and have meals during nighttime hours (Nakamura et al., 2018; Yoshizaki et al., 2023). These irregular eating patterns can negatively impact chrono-nutrition and circadian rhythms.

In conclusion, shift work, especially night shifts, appears to adversely affect both the quality and timing of dietary intake. Shift workers tend to have less healthy diets higher in energy-dense foods, with irregular meal patterns that conflict with normal circadian rhythms. More research is needed to fully elucidate the relationships between shift work, chrono-nutrition, and long-term health outcomes. Targeted interventions to improve shift workers' diet quality and meal timing may be warranted to mitigate potential negative health effects.

2.13. Association of Body Composition and Chrono-nutrition in Shift work :

Chrono-nutrition, which examines the relationship between meal timing and health outcomes, has significant implications for shift workers. Research indicates that shift work can disrupt circadian rhythms and eating patterns, potentially leading to adverse health effects (Pot, 2017). Studies on shift workers, particularly in healthcare settings, have revealed notable differences in dietary habits compared to day workers. Shift workers tend to have irregular eating patterns, delayed meal timing, and lower diet quality (Farías et al., 2020). They also show a higher propensity for consuming caffeine, snacks, and eating at night, while having lower fruit and vegetable intake (Pepłońska et al., 2019). These altered eating behaviors may contribute to metabolic disturbances and weight gain over time.

Interestingly, the impact of shift work on body composition appears to manifest gradually. A study on graduate paramedics found significant increases in weight, BMI, and waist circumference after two years of shift work, despite no initial changes in daily energy intake or diet quality scores (Clark et al., 2023). This suggests that the long-term effects of shift work on body composition may be cumulative and not immediately apparent.

In conclusion, the association between chrono-nutrition and body composition in shift workers is complex and multifaceted. While immediate changes in dietary patterns are observed, alterations in body composition may take longer to manifest. These findings highlight the importance of developing targeted interventions to support healthy eating habits and weight management among shift workers (Clark et al., 2023; Pot, 2017).

2.14. Association of Physical Activity and Chrono-nutrition in Shift work:-

Physical activity and chrono-nutrition patterns among shift workers show significant variations compared to day workers, with potential implications for their health and well-being. Shift workers, particularly those on night shifts, tend to have lower physical activity levels and altered eating patterns. Night shift workers were found to have fewer steps, more sedentary time, and less moderate activity during their shifts compared to day workers (Mansouri et al., 2021). Similarly, rotating shift workers showed less overall activity than day and night shift workers (Chen et al., 2020).

Interestingly, chrono-nutrition patterns among shift workers reveal several contradictions. While some studies reported lower total energy intake among shift workers (Farías et al., 2020; Ohtsuka, 2001), others found higher calorie consumption, especially during night shifts (Chen et al., 2020; Mansouri et al., 2021). Shift workers also exhibited irregular eating patterns, delayed meal timing, and decreased diet quality (Farías et al., 2020; Yoshizaki et al., 2023). Night shift workers, in particular, showed a shorter maximum fasting interval, more eating moments, and a higher percentage of fat intake during their shifts (Langenberg et al., 2018).

In conclusion, the association between physical activity and chrono-nutrition in shift work is complex and multifaceted. The disruption of circadian rhythms due to shift work appears to impact both physical activity levels and eating patterns. These alterations may contribute to the increased risk of obesity, metabolic disorders, and other health issues observed in shift workers. Future interventions should consider both physical activity promotion and chrono-nutrition strategies tailored to the unique challenges faced by shift workers.

2.15. Association of Screen time and Chrono-nutrition in Shift work:-

Chrono-nutrition, which examines the relationship between meal timing and health outcomes, is particularly relevant for shift workers who often experience disruptions to their circadian rhythms (Takahashi & Tahara, 2022). Shift work, especially night shifts, can lead to alterations in biological clocks, affecting psychosocial well-being and circadian nutritional intake (Azmi et al., 2020). This disruption is associated with an increased risk of metabolic disorders and oxidative stress (Gowda et al., 2019). While the provided papers do not directly address screen time in relation to chrono-nutrition for shift workers, they offer insights into related aspects. For instance, Langenberg et al.(2018) highlights the importance of daylight exposure patterns for night-shift workers, which could be relevant when considering screen time.

Additionally, Kervezee et al. (2021) discusses how chronotype (individual preference for sleep-wake timing) interacts with shift type to affect sleep duration, which could have implications for screen time habits.In conclusion, while the direct association between screen time and chrono-nutrition in shift work is not explicitly addressed in the given context, the research emphasizes the importance of timing in nutrition and light exposure for shift workers' health. Future studies could explore how screen time, as a source of light exposure and a potential influence on eating patterns, might interact with chrono-nutrition principles in the context of shift work.

2.16. Association of Mental Health and Chrono-nutrition in Shift work:-

Chrono-nutrition, which focuses on the timing of eating, has been increasingly recognized as an important factor in the health outcomes of shift workers. Research suggests that irregular meal patterns and disrupted circadian rhythms associated with shift work can have negative impacts on mental health (Pot, 2017; Zhao et al., 2019). Studies have found that shift workers, particularly those working night shifts, are at higher risk for mental health issues like depression and minor psychiatric disorders compared to day workers (Arruda et al., 2014).

The intention to leave night shift work was also associated with a greater chance of minor psychiatric disorders, indicating that those less tolerant to night work may be more susceptible to mental health effects (Arruda et al., 2014).

Interestingly, the duration of exposure to night work was not significantly associated with mental health symptoms in one study, suggesting that individual tolerance may play a larger role than cumulative exposure (Arruda et al., 2014). However, shift work was associated with sleep deprivation and changes in dietary patterns, including increased calorie intake and higher-fat and carbohydrate diets (Chen et al., 2020; Lowden et al., 2010). These factors could potentially mediate the relationship between shift work, chrono-nutrition, and mental health outcomes.

In conclusion, while the direct association between chrono-nutrition and mental health in shift workers requires further research, the evidence suggests that disrupted eating patterns and circadian rhythms associated with shift work may contribute to poor mental health outcomes. Implementing chrono-nutrition strategies and providing consistent dietary guidance for shift workers could potentially help mitigate these negative effects (D'annibale et al., 2021).

METHODS AND MATERIALS

The present investigation was undertaken "To Study the Chrono-nutrition profile of Rotational shift workers and regular shift workers." This chapter outlines the study design, methodology, and materials used to fulfil the research objectives.

Objectives:-

Broad Objective:

- To study the Chrono-nutrition profile of Rotational and Regular Shift workers.

Specific Objectives:

- To identify the chronotype and Chrono-nutrition profile of rotational and regular shift workers.
- To assess the work environment of regular and rotational shift workers (regarding work hours, food availability and utilisation).
- To study the body composition, physical activity level, dietary intake, stress and sleep patterns of rotational and regular shift workers.
- To study the association of the chronotype and chrono-nutrition profile of shift workers (rotational shift worker and regular shift worker) with their dietary intake, body composition, physical activity level, stress, and sleep pattern.

Sample Size: 200 subjects were enrolled in the study, with 100 participants from rotational shifts and 100 from regular shifts.

Sample Size Calculation:-

Sample Size Determination: The sample size was estimated to ensure adequate statistical power to detect meaningful differences between the two groups. Two different sample size formulas were used since the study involves continuous and categorical variables.

1. Sample Size Calculation for Continuous Variables (e.g., BMI, sleep scores)

For comparing two independent means (e.g., BMI between rotational and regular shift workers), the required sample size per group was calculated using the following formula:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times 2\sigma^2}{\Delta^2}$$

Where:

- n = Required sample size per group
- Z α/2 = 1.96 (for 95% confidence level)
- Z β = 0.84 (for 80% power)
- σ = Standard deviation (assumed 3 kg/m² for BMI)
- Δ = Expected difference between groups (assumed 1.5 kg/m²)

Calculation:

$$n = \frac{(1.96+0.84)^2 \times 2 \times 3^{2\surd\surd}}{1.5^2}$$

$$n = \frac{(2.8)^2 \times 18}{2.25}$$

$$n = \frac{7.84 \times 18}{2.25} = \frac{141.12}{2.25} = 62.7$$

After rounding up and adjusting for **10% dropout**, the final sample size per group:

n=70 per group ⇒Total = 140 participants

2. Sample Size Calculation for Categorical Variables (e.g., Chronotype Distribution)

For comparing proportions (e.g., percentage of morning-type workers in each group), the required sample size was calculated using the formula:

$$n = \frac{(Z_{\alpha/2}\sqrt{2P(1-P)} + Z_{\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)})^2}{(P_1 - P_2)^2}$$

Where:

- P_1 = Proportion of morning-type individuals in regular shift workers (assumed 50%)
- P_2 = Proportion of morning-type individuals in rotational shift workers (assumed 35%)
- P = Pooled proportion = P_1+P_2 / 2 = 0.50+0.35 / 2 = 0.425

Calculation:

$$n = \frac{(1.96 \times \sqrt{2(0.425)(0.575)} + 0.84 \times \sqrt{(0.50)(0.50) + (0.35)(0.65)})^2}{(0.50 - 0.35)^2}$$

$$n = \frac{(1.96 \times \sqrt{0.488}) + (0.84 \times \sqrt{0.5 + 0.2275})^2}{0.15^2}$$

$$n = \frac{(1.96 \times 0.6986) + (0.84 \times 0.8365)^2}{0.0225}$$

$$n = \frac{(1.37) + (0.70)^2}{0.0225}$$

$$n = \frac{(2.07)^2}{0.0225} = \frac{4.28}{0.0225} = 190.2$$

After rounding up and adjusting for **10% dropout**, the final sample size per group:

n=187 per group ⇒ Total = 374 participants

Final Sample Size Decision

- The continuous variable calculation suggested 140 participants (70 per group).
- The categorical variable calculation suggested 374 participants (187 per group).
- To balance feasibility and statistical power, the study opted for a total sample size of 200 participants (100 per group).

Sampling Technique: The sample size was selected through purposive sampling, which involves purposively selecting any esteemed organisation with employees with rotational and regular shift schedules and who have been granted permission.

Study Design: This study is a cross-sectional study based in Urban Vadodara.

INCLUSION AND EXCLUSION CRITERIA:

Inclusion criteria-

- Rotational and regular shift workers doing rotational shifts and fixed shifts respectively for a minimum of 1 year.

- Participants who give written consent.

Exclusion criteria –

- Participants with major health concerns or medications that could significantly affect mental health, sleep, diet, and physical activity.

Ethical Approval:

The study was approved by the Institutional Ethical Committee for Human Research (IECHR) of the Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The ethical approval number of the study is **IECHR/FCSc/M.Sc./10/2024/47**.

Methodology:-

Written informed consent was obtained from the subjects before enrolling them in the study. The following data was collected through a combination of questionnaires, interviews, and physical measurements, focusing on the following parameters:

1. Sociodemographic Profile: Information regarding working hours, food availability, and utilization at the workplace was gathered using a structured questionnaire and interviews.

2. Nutritional Status:

Anthropometric measurements include:

Height: The height was measured using a Stadiometer.

Weight, BMI (Body Mass Index) and Body Composition: These were measured using Omron Fully Body Sensor Body Composition Monitor and Scale Model HBF-375.

According to the NHLBI, BMI is calculated as weight in kilograms divided by the square of the height in meters(kg/m^2) and has been categorised into 4 groups according to the Asian-Pacific classification. BMI = Weight (kg) / Height (m^2)

Table 3.1: BMI Asia-Pacific Classification:

Category	Asia-Pacific BMI Cut-offs
Underweight	< 18.5
Normal	18.5-22.9
Overweight	23-24.9
Obese	>25

The body composition which includes body fat, visceral fat and skeletal muscle was measured using the Omron Full Body Sensor Body Composition Monitor and Scale(Model HBF 375) that estimates the body fat percentage by the Bioelectrical Impedance method having a weak electrical current of 50kHz and less than 500Ma. Body tissues having higher water content including muscles, blood, and bones conduct electricity easily. Body fat does not store much water and, therefore has little electric conductivity and higher resistance which slows the rate of travel of current and therefore helps to estimate the fat, visceral fat, and muscle content of the body.

Body Fat: Body fat serves a vital role in storing energy and protecting internal organs. We carry two types of fat in our bodies: 1) essential fat which is stored in small amounts to protect the body and 2) stored fat which is stocked for energy during physical activity. While too much body fat may be unhealthy, having too little fat can be just as unhealthy. Body fat was classified according to the cut-offs provided by Omron Healthcare.

Table 3.2: Body Fat Percentage Classification:

Classification	Male	Female
Low(-)	5.0-9.9 %	5.0 – 19.9%
Normal(0)	10.0 – 19.9%	20.0-29.9%
High(+)	20.0 – 24.9%	30.0 – 34.9%
Very High (++)	≥ 25.0 %	≥ 35.0 %

Source: (Omron Healthcare)

Visceral Fat: Visceral fat is found in the abdomen and surrounding vital organs. It is different from the subcutaneous fat. Too much visceral fat is thought to be closely linked to increased levels of fat in the bloodstream, which may lead to conditions such as high cholesterol, heart disease and type 2 diabetes.

Table 3.3: Classification of Visceral Fat:

Category	Cut-off
Normal	≤ 9
High	10-14
Very High	≥ 15

Source: (Omron Health care)

Skeletal Muscle: Skeletal muscles is attached to the skeleton and come in pairs -muscle to move the bone in one direction and another to move it back the other way. Increasing skeletal muscle will increase your body's energy requirements. The maintenance and increase of skeletal muscle are closely linked to the resting metabolism rate.

Table 3.4: Classification of Skeletal Muscle:

Gender	Age	Low(-) %	Normal (0) %	High (+) %	Very High (++) %
Female	18-39	<24.3	24.3- 30.3	30.4 – 35.3	≥ 35.4
	40-59	<24.1	24.1 – 30.1	30.2 – 35.1	≥ 35.2
	60-80	<23.9	23.9 – 29.9	30.0 – 34.9	≥ 35.0
Male	18-39	<33.3	33.3 -39.3	39.4 – 44.0	≥ 44.1
	40-59	<33.1	33.1 – 39.1	39.2 – 43.8	≥ 43.9
	60-80	<32.9	32.9 – 38.9	39.0 – 43.6	≥ 43.7

Source: (Omron Health care)

3. Diet Information: Dietary intake was assessed using a 3-day 24-hour dietary recall method, covering two workdays and one non-workday for regular shift workers while for rotational shift workers one regular shift /morning shift working day and another of rotational shift day (evening/night) and one non-workday(free day). The 24-hour dietary recall is a structured interview that captures detailed information about all foods and beverages consumed by the respondent in the past 24 hours. Nutritional analysis was performed using Nutrical software to evaluate dietary patterns and nutrient intake.

4. Chronotype: The chronotype of participants was assessed using the Horne and Ostberg Morningness - Eveningness Questionnaire involves 19 questions in the questionnaire to determine morningness-eveningness in human circadian rhythms and the Munich Chronotype Questionnaire (MCTQShift) adapted specifically for shift workers. The MCTQShift assesses a person's sleep-wake rhythms, including sleep latency, energy levels, and exposure to daylight, shift-specific mid-sleep time (MSF(E)), which is the time they fall asleep in the middle of a shift.

5. Physical Activity: Physical activity levels and sedentary behaviour was evaluated using the Global Physical Activity Questionnaire (GPAQ). The Global Physical Activity Questionnaire was developed by WHO for physical activity surveillance in countries. It comprises of 16 questions including domains of: 1) Activity at work 2)Travel to and from places 3) Recreational activities. Information on the type and duration of activity was obtained from the GPAQ questionnaire and the Exercise Energy Expenditure (EEE) was calculated using the following formula EEE = Time(hour) *RMR/24*MET.

6. Sitting Time: Assessment of sitting time will be conducted based on thresholds defined in the study "Sitting time and all-cause mortality risk in 2012".The categories are as follows:

Table 3.5: Sitting hours and associated risk:

Category of Risk	**Hours of Sitting**
Low Risk	< 4hours/day
Medium Risk	4-8 hours /day
High Risk	8-11hours /day
Very High Risk	>11hours /day

Source: (van der Ploeg et al.)

7. Stress: Stress levels were measured using the Perceived Stress Scale (PSS) by Sheldon Cohen. The Perceived Stress Scale (PSS) is the most widely used psychological instrument for measuring the perception of stress. It is a measure of the degree to which situations in one's life are appraised as stressful. Scoring of PSS ranges from 0-13(low), 14-26 (moderate) and 27-40(high).

8. Sleep: Sleep quality and patterns were evaluated using the Pittsburgh Sleep Quality Index (PSQI). It contains 19 self-rated questions and 5 questions rated by a bed partner or roommate. The scoring is divided into 7 components which have a range of 0-3 points with 0 scoring indicating no difficulty while scoring of 3 indicating severe difficulty. The score of the 7 components are then added and one global score is obtained that ranges from 0-21 where 0 indicates no difficulty and 21 indicates severe difficulties in all areas. A global score of 5 or more indicates poor sleep quality.

9. Screen Time: An 18-item screen-time questionnaire was created to quantify the use of commonly used screen devices (e.g. television, smartphone, tablet) across different time points during the week (e.g. weekday, weeknight, weekend).

10. Chrono-nutrition Profile: Chrono-nutrition profile was assessed using the chrono-nutrition profile scoring method developed by Allison Christine Engwall. Six chrono-nutrition behavior cut-off scores are categorized into one of three 'chrono-nutrition behavior cut-offs' for each chrono-nutrition behavior (0 = good,1= fair and 2= poor). These scores were added to obtain the Chrono-nutrition Profile score, which represents one's chrono-nutrition profile. Scoring ranges from 0 to 12, with 0 indicating good chrono-nutrition status and 12 indicating poor chrono-nutrition status (Engwall A.C.,2018)

The 6 indicators are:

- Eating Window – It includes the duration between the first eating event and the last eating event(HH: MM)
- Breakfast Skipping – It includes the frequency of breakfast skipping. (Days/Week)
- Evening Latency – It includes the duration between the last eating event and sleep onset(HH: MM)
- Evening Eating- It includes the risk of eating late in the waking day(HH: MM)
- Night Eating – It includes frequency of night eating(Days/Week)
- Largest Meal – It includes a meal in which a large amount of food is eaten. (Meal Name)

Table 3.6: Chrono-nutrition Behaviour description and scoring cut-offs:

Chrononutrition Cut-offs	Description	Format	Scoring Cutoff (poor, fair, good)
Eating Window	Duration between first eating event and last eating event	HH: MM	≥14:00 12:01-14:00 ≤ 12:00
Breakfast Skipping	Frequency of Breakfast Skipping	Days/Week	>4days/week 2-3days/week 1day/week or less
Evening Latency	Duration between last eating event and sleep onset	HH: MM	<2:00 02:01 – 06:00 >6:00
Evening Eating	Risk of eating late in the waking day	HH: MM	>23:00 20:00 – 22:59 <20:00
Night Eating	Frequency of night eating	Days/Week	>4days/week 2-3days/week 1day/week or less
Largest Meal	Meal in which largest amount of food is eaten	Meal Name	Dinner/Supper Lunch Breakfast

(Source: Engwall A.C. (2018)Development, Validation, and reliability of the Chrono-nutrition Profile)

Statistical Analysis: Data analysis was conducted using statistical software such as Microsoft Excel and SPSS. Descriptive statistics were computed to summarize the means, standard deviations, and distributions of the collected data. Comparative analyses were performed using t-tests for independent samples, ANOVA, or non-parametric alternatives, as appropriate, to assess differences between regular and rotational shift workers.

RESULTS AND DISCUSSION

The present investigation aims to study the chrono-nutrition profile of rotational shift workers and regular shift workers. This chapter is organized into sections, each focusing on a specific aspect:

Section 4.1 Socio-demographic information: Understanding the similarities and differences of both types of shift workers in their age group, educational qualification, work environment and shift duration.

Section 4.2 Nutritional Status: Assessing the anthropometric measurements and body composition of participants.

Section 4.3 Diet Information: Briefing on the specific dietary habits and patterns observed.7

Section 4.4 Assessment of the chronotype of both types of Shift Workers

Section 4.5 Assessment of sleep metrics and chronotype among Rotational Shift workers: Assessing the similarities and differences in sleep duration, social jetlag, sleep debt, alarm use and chronotype and chrono disruption

Section 4.6 Perceived Stress: Understanding the level of stress in both types of shift workers.

Section 4.7 Sleep Quality: Investigating the sleep quality differences in both types of shift workers.

Section 4.8 Physical Activity: Analysing the levels of physical activity among both types of shift workers.

Section 4.9 Sitting Time: Understanding the sedentary behaviour

Section 4.10 Screen time: Assessing the amount of time spent on electronic devices during weekdays, weeknights, and weekends, including primary and background screen time.

Section 4.11 Association of Chronotype and Dietary Intake of both types of Shift Workers

Section 4.12 Association of Chrono-nutrition Profile with Nutritional Status, Physical Activity

Section 4.1 - Socio-Demographic Information

Table 4.1.1: Socio-Demographic Information of Shift Workers

Variables	**Regular Shift Workers**	**Rotational Shift Workers**
Total No. of Participants	**100**	**100**
Age Group	**N(%)**	**N(%)**
18-28	34(34)	55 (55)
29-39	31(31)	32 (32)
40-50	17(17)	13 (13)
>50	11(11)	0 (0)
Educational Qualification		
1st – 9th Std	12(12)	17 (17)
10th – 12th Std	34(34)	41 (41)
Diploma	16(16)	16 (16)
Graduate	31(31)	20 (20)
Post Graduate	7(7)	6 (6)
Job Role Category		
Worker	37(37)	17 (17)
Supervisor	48(48)	41 (41)
Admin	15(15)	16 (16)

The data was collected from 200 male participants, of which 100 of Rotational shift workers and 100 of Regular shift workers from the same industry. There were four types of shifts – General, Morning, Evening, Night. General shift is a regular shift of 9:30 am-5:30 pm timing followed by Regular shift workers. While the Rotational shift workers have Morning, evening, and night shifts. The shift changes weekly in the following cycle-Morning to Night to Evening and then again to Morning, that is how the shift rotates. The timings for morning, evening and night shift are 7:00 am-3:00 pm,3:00-11:00 pm, and 11:00 pm – 7:00 am, respectively. Both types of shift workers have weekly one day off.

They have 8 hours of shift with food availability at the workplace, including breakfast, snack, lunch, and dinner for both types of shift workers.

Table 4.1.1 presents the socio-demographic profile of shift workers. Among rotational shift workers, the largest proportion (38%) belonged to the 24-29 age group, while for regular shift workers, 27% were from the same age category. Interestingly, a significant percentage (18%) of regular shift workers were aged above 50, whereas no rotational shift workers were in this category.

This indicates that regular shift work may be a more suitable or practical option for older employees. While 55% of rotational shift workers lie in the 18- 28-year age group, this suggests a trend where younger employees are more likely to be engaged in rotational shift work, possibly due to better adaptability to irregular work hours or physical demands associated with such schedules. Previous studies have similarly reported that younger workers are more commonly assigned to rotational or night shifts, likely due to greater resilience and fewer familial obligations.

In terms of educational qualifications, most shift workers had completed 10th- 12th standard education (41% in rotational and 34% in regular shift workers). Graduate-level education was more common among regular shift workers (31%) compared to rotational shift workers (20%).These differences might reflect role-specific requirements or hiring trends within the organization, where higher academic qualifications may be preferred for roles that align with regular shifts and administrative duties (Bambra et al., 2008).

Regarding job roles, a higher proportion of regular shift workers were supervisors (48%) compared to rotational shift workers (41%).

Similarly, more regular shift workers were in administrative positions (15%) than rotational shift workers (16%).

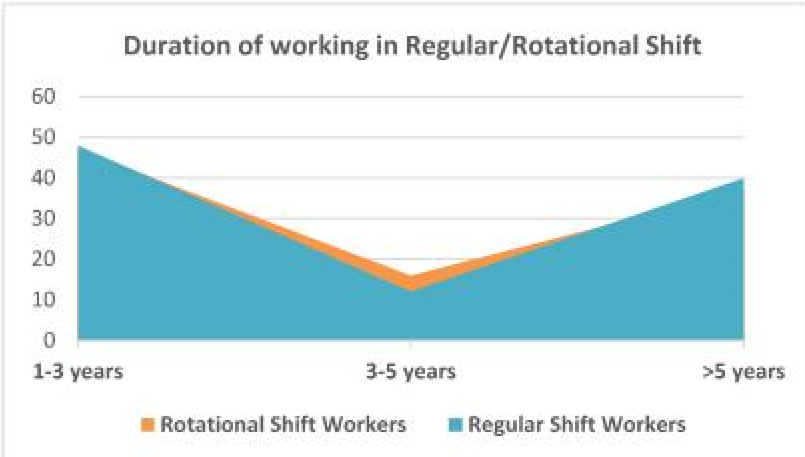

Fig. -4.1.2 – Shift working duration

Fig. 4.1.2 shows the duration of employment in a particular shift. Nearly half of both groups (47% in rotational and 48% in regular shifts) had been working in their respective shifts for 1-3 years. Long-term employment (>5 years) was slightly higher among regular shift workers (40%) than rotational shift workers (37%). The higher retention beyond five years among regular shift workers suggests greater long-term sustainability of fixed schedules, potentially due to better alignment with social and biological rhythms (Knutsson, 2003).Early exit from rotational schedules is often linked to circadian disruption, poor sleep quality, and increased work-life conflict (Costa, 2010; Folkard & Tucker, 2003).

Section 4.2 – Nutritional Status

Table 4.2.1 BMI Distribution among Shift workers:-

Rotational Shift Workers			
BMI	**Cut-off**	**Mean ± SD**	**N(%)**
Underweight	**<18.5**	17.16 ± 0.77	11 (11)
Normal	**18.5-22.9**	20.76 ± 1.30	38 (38)
Overweight	**23-24.9**	24.08 ± 0.65	13 (13)
Obese	**>25**	28.38 ± 3.14	38 (38)
Regular Shift Workers			
BMI	**Cut-off**	**Mean ± SD**	**N(%)**
Underweight	**<18.5**	17.28 ± 1.03	10 (10)
Normal	**18.5-22.9**	20.78 ± 1.22	29 (29)
Overweight	**23-24.9**	24.18 ± 0.51	17 (17)
Obese	**>25**	28.43 ± 2.47	44 (44)

BMI distribution indicated that obesity was present in 38% of rotational shift workers and 44% of regular shift workers, suggesting a slightly higher prevalence in the latter group. It can be due to physical work demands in rotational shift, like carrying loads, and standing for long hours, which make them more physically active than regular shift workers. The percentage of underweight individuals was similar across both groups (11% in rotational and 10% in regular shift workers), indicating that nutritional deficiencies or irregular eating patterns may be common among both types of workers. This is consistent with prior research suggesting that shift work—regardless of type—can disrupt eating routines and reduce diet quality, leading to both under- and over-nutrition (Antunes et al., 2010). The mean BMI values were slightly higher in regular shift workers across categories, particularly in the overweight and obese groups. Studies have shown that regular shift workers may have more structured but less physically intensive roles, contributing to gradual weight gain over time (Wang et al., 2011; Kivimäki et al., 2006).

Table 4.2.2 Body Composition among Shift workers

Variables	Cut-off	Mean ± SD	N(%)
Rotational Shift Workers			
Body Fat(%)			
Low(-)	**5.0 - 9.9%**	8.63 ± 0.33	3 (3)
Normal(0)	**10 - 19.9%**	16.44 ± 2.20	25 (25)
High(+)	**20 - 24.9%**	22.40 ± 1.20	25 (25)
Very High(++)	**≥25.0%**	28.46 ± 2.63	47 (47)
Visceral Fat			
Normal	**0.5-9.5**	4.76 ± 2.49	61 (61)
High	**10-14.5**	12.03 ± 1.74	29 (29)
Very High	**15-30**	20.19 ± 4.78	10 (10)
Skeletal Muscle(%)			
Low(-)	**5-32.8%**	30.12 ± 1.92	69 (69)
Normal(0)	**32.9-35.7%**	34.08 ± 0.78	19 (19)
High(+)	**35.8-37.3%**	36.29 ± 0.52	7 (7)
Very High(++)	**37.4-60%**	37.98 ± 0.66	5 (5)
Variables	**Cut-off**	**Mean ± SD**	**N(%)**
Regular Shift Workers			
Body Fat(%)			
Low(-)	**5.0 - 9.9%**	-	0(0)
Normal(0)	**10 - 19.9%**	15.20 ± 2.87	13(13)
High(+)	**20 - 24.9%**	22.59 ± 1.46	21(21)
Very High(++)	**≥25.0%**	29.92 ± 3.37	66(66)
Visceral Fat			
Normal	**0.5-9.5**	5.25 ± 2.74	52(52)
High	**10-14.5**	12.20 ± 1.41	35(35)
Very High	**15-30**	17.58 ± 1.77	13(13)
Skeletal Muscle(%)			
Low(-)	**5-32.8%**	29.03 ± 2.23	77(77)
Normal(0)	**32.9-35.7%**	34.09 ± 0.68	17(17)
High(+)	**35.8-37.3%**	36.30 ± 0.00	2(2)
Very High(++)	**37.4-60%**	38.18 ± 0.51	4(4)

Table 4.2.2 presents body fat percentage showed that a significantly higher proportion of regular shift workers (66%) fell into the "Very High body fat category compared to rotational shift workers (47%). The absence of any participants in the low body fat category among regular shift workers, and only 3% in that category among rotational

shift workers, further supports the overall trend toward increased fat accumulation in this population. High body fat, particularly in the visceral region, has been linked to increased risk of metabolic syndrome, cardiovascular disease, and insulin resistance (Després et al., 2008)

Similarly, the mean visceral fat level was higher among regular shift workers (17.58 ± 1.77) than rotational shift workers (20.19 ± 4.78), reinforcing the trend of increased adiposity in regular shift workers. Elevated visceral fat is more metabolically active and dangerous than subcutaneous fat, making its accumulation particularly harmful for long-term health (Fox et al., 2007).The differences in the working nature of both types of shift workers lead to higher body fat in regular shift workers. The regular shift workers' nature of work involves a sitting job for longer hours, along with high screen time. Interestingly, although the mean visceral fat levels were slightly higher in regular shift workers across categories, the standard deviations also suggest a wider variability, possibly due to differences in diet, or sedentary behaviour.

In contrast, skeletal muscle mass was lower in regular shift workers, with 77% categorized as having "Low" skeletal muscle percentage, compared to 69% of rotational shift workers. This suggests that rotational shift workers may have better muscle retention, due to differences in physical activity level.

Skeletal muscle mass is an essential predictor of metabolic health and functional capacity, an lower percentages are associated with greater risk of insulin resistance, and poor physical performance (Srikanthan et al., 2010)

Section 4.3 - Diet Information

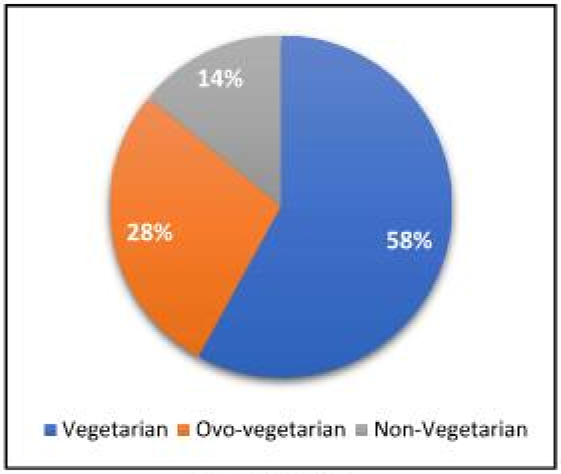

Fig. 4.3.1(a)

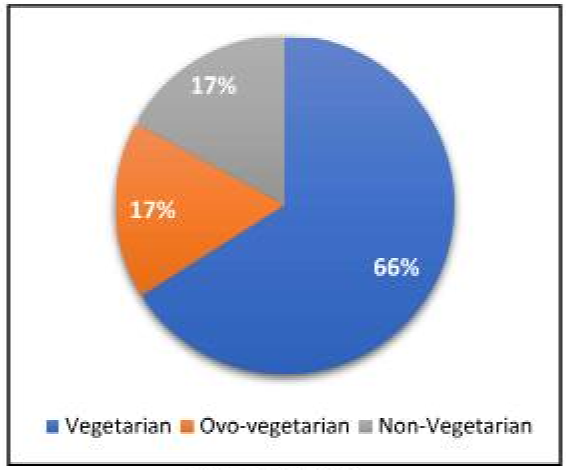

Fig. 4.3.1(b)

Fig. 4.3.1(a) and (b) – Dietary Preference among Shift workers

Figure 4.3.1 (a) & (b) details the food choice among the participants. The majority (66%) of regular shift workers were vegetarian, followed by 58% of rotational shift workers who prefer vegetarian food. Out of 100 rotational shift workers,28% were ovo-vegetarian and the rest of 14% were non-vegetarian. While regular shift workers have the same number of participants (17%), they prefer ovo-vegetarian and non-vegetarian. This shows that while the majority across both groups lean toward vegetarian diets, rotational shift workers have a higher diversity in dietary types, possibly due to irregular meal timings and higher energy demands requiring more flexible food options (Gupta et al., 2021).Shift work, particularly rotational shifts, has been associated with altered appetite regulation, meal skipping, and increased snacking, which can influence dietary choices (Lowden et al., 2010).

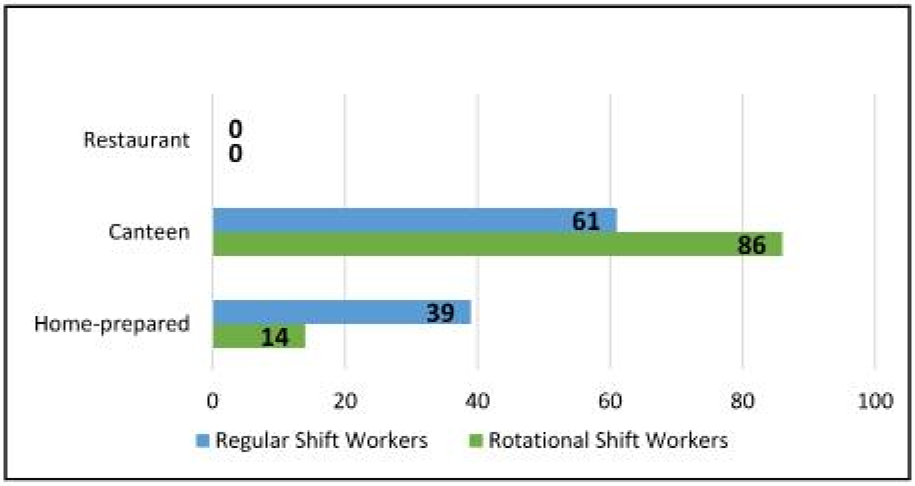

Fig. 4.3.2 – Sources of Meals during Working Hours

Fig. 4.3.2 shows that many workers are having a meal at the workplace canteen, with about 86% and 61% of rotational and regular shift workers, respectively, followed by 39% and 14% sourcing from home-prepared meals of regular and rotational shift workers. It shows that most rotational shift workers source their meals from the workplace canteen as it's hard to manage meals while being on different shifts weekly, mainly on night and evening shifts due to time constraints, lack of access to home-cooked food during odd hours(Atkinson et al., 2008) This leads to limited dietary choice diversity in the diet as the menu changes monthly in the workplace canteen, with limitations to certain food items. The challenge of accessing fresh, nutrient-dense meals during late or rotating shifts may contribute to poor metabolic outcomes in this group (Zuraikat et al., 2021).

The home prepared meals are mostly sourced by regular shift workers, which leads to more scope for dietary diversity, dietary preferences and food choices and affects dietary intake. Regular hours provide more opportunity for planning and preparing meals, which aligns with previous research suggesting that home cooking is linked to healthier eating habits and improved nutritional intake (Wolfson et al., 2015).

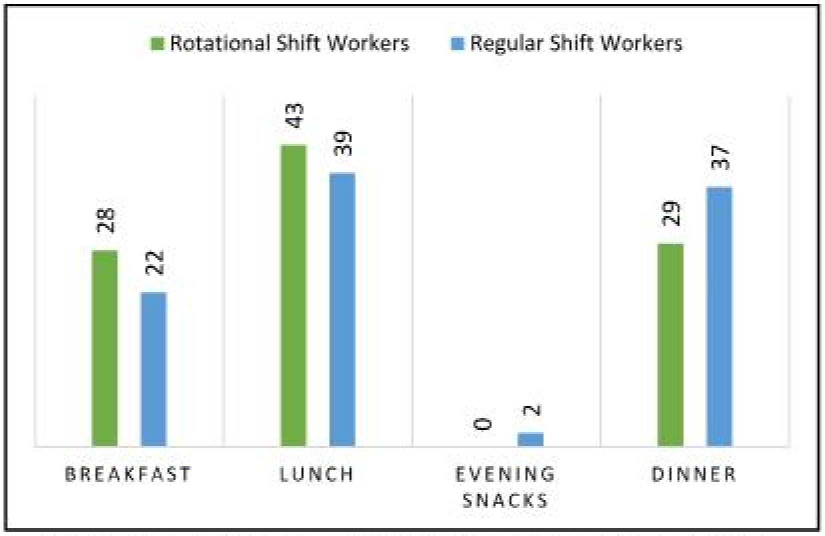

Fig. 4.3.3 – Most Important meal among Shift workers

Fig. 4.3.3 presents the study's participants' perceptions of the most significant meal of the day. According to the findings,43% of rotational shift workers and 39% of regular shift workers ranked lunch as their most important meal, followed by dinner preference of about 29% and 37% by rotational and regular shift workers, respectively. This pattern might reflect the more consistent evening routines and family-based eating practices of regular workers, who tend to finish work by evening (Reeves et al., 2004).Breakfast was stated as the important meal by 28% of rotational shift workers, followed by 22% of regular shift workers. Evening snacks were preferred by none of the rotational shift workers, followed by only 2% of regular shift workers, potentially due to the clashing of working timings with evening snacks time.

Table 4.3.4 – Homemade food consumption Frequency and Meal Skipping Frequency during work hours

	Rotational Shift Workers	Regular Shift Workers
Homemade food frequency	**N(%)**	**N(%)**
Never	34 (34)	40(40)
1 time a week	32 (32)	32(32)
2 times a week	24 (24)	12(12)
3-4times a week	8 (8)	12(12)
5-6 times a week	2 (2)	4(4)
Skipping meals frequency	**N(%)**	**N(%)**
Never	36 (36)	52(52)
1 time a week	46 (46)	42(42)
2 times a week	24 (24)	6(6)
3-4times a week	18 (18)	0(0)
5-6 times a week	0(0)	0(0)

Table 4.3.4 shows that about 2% and 8% of the rotational shift workers and 4% and 12% of the regular shift workers had homemade food 5-6 times and 3-4 times respectively in a week. Majority of the rotational shift workers (34%) and regular shift workers (40%) did not have homemade meals and preferred food served at the workplace canteen. The frequency of consumption of homemade foods, once to twice a week, ranged from 32% to 24% among rotational shift workers and from 32% to 12% among regular shift workers. It has been noted that shift workers often rely on workplace or convenience foods due to irregular schedules and fatigue, which limits their ability to prepare food at home (Sudo et al., 2021).

Meal skipping was more prevalent among rotational shift workers, with 18% skipping meals three to four times per week, whereas none of the regular shift workers exhibited this behaviour. Notably, 52% of regular shift workers never skipped meals. This aligns with literature suggesting that non-standard work hours disrupt appetite and lead to irregular meal patterns (Lowden et al., 2010).Among rotational shift workers, 24% skipped meals at least twice a week, while 46% skipped meals at least once a week.

These trends suggest that irregular work schedules, workload demands, and limited food choices at the workplace may contribute to meal skipping behaviours among rotational shift workers, potentially impacting appetite regulation and overall dietary intake. The physiological consequences of frequent meal skipping include reduced metabolic efficiency, increased fat accumulation, and poor glucose control, particularly among shift workers with disrupted circadian rhythms (Patel et al., 2014).

Section 4.4 - Chronotype Classification

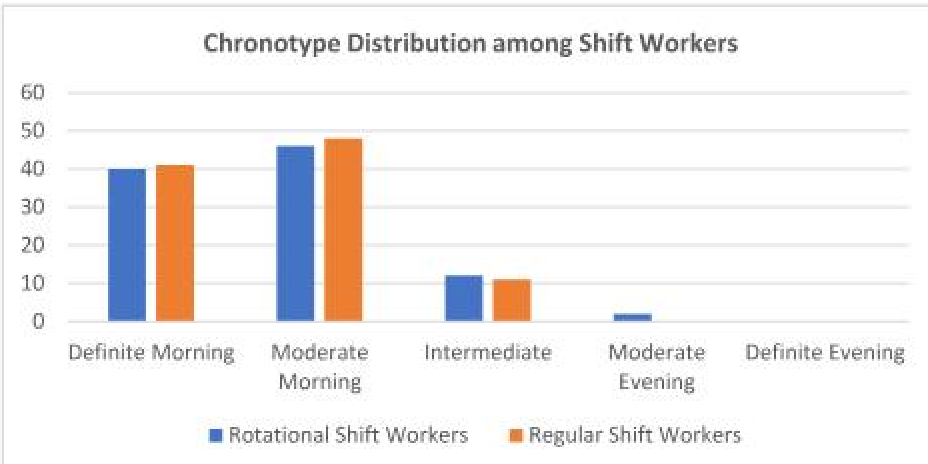

Fig 4.4.1 – Chronotype distribution among shift workers

The morning chronotype was dominant in both groups, with 40% of rotational shift workers and 41% of regular shift workers identified as "Definite Morning" types. "Moderate Morning" chronotypes were slightly more common among regular shift workers (48%) compared to rotational shift workers (46%). Only rotational shift workers were in the "Moderate Evening" category (2%), while none were classified as "Definite Evening" type. This could reflect an adaptation among workers to the demands of their schedules. Regular shift workers typically work fixed daytime hours, potentially reinforcing morning-oriented circadian preferences. On the other hand, rotational shift workers, despite their exposure to varying schedules, also showed a dominant morning chronotype, which may suggest either a selection bias in shift assignment or long-term adaptation (Antunes et al., 2010).

Section 4.5– Assessment of Chronotype among Shift Workers

Table 4.5.1 – Sleep-Wake patterns assessment along with Alarm Use Frequency

	Sleep Onset (hh: mm)	**Wakeup Time (hh: mm)**	**Sleep Duration (hh: mm)**	**Mid-sleep time (hh: mm)**	**Alarm Use**
Workdays		**Mean ± SD**	**(Median)**		
Morning	20:12 ± 6:48	5:33 ± 0:44	6:41 ± 1:16	2:12 ± 0:45	75%
(Median)	(22:30)	(05:30)	(06:45)	(02:15)	
Evening	19:27 ± 13:37	7:41 ± 1:36	6:57 ± 2:56	22:56 ± 13:41	49%
(Median)	(01:30)	(8:00)	(06:45)	(04:51)	
Night	10:26 ± 2:17	15:46 ± 1:56	5:19 ± 2:02	13:06 ± 1:52	57%
(Median)	(10:00)	(16:00)	(05:15)	(13:22)	
Free day	19:13 ± 7:58	7:36 ± 1:38	8:32 ± 1:39	3:19 ± 1:15	26%
(Median)	(22:30)	(07:30)	(08:25)	(03:15)	

Table 4.5.1 presents sleep-wake patterns among rotational shift workers during morning, evening, night shift, and on a free day and shows dependency on alarm use during each shift. Let us discuss it shift-wise: On workdays, during morning shift, rotational shift workers had a mean sleep onset of 20:12 and wake-up time of 5:33, with sleep duration of approximately 6 hours and 41 minutes. This pattern reflects an early chronotype, consistent with expectations for morning-oriented schedules. Alarm use was highest in this group (75%), indicating strong external regulation of wake times, which may contribute to sleep restriction and social jetlag (Wittmann et al., 2006).

During evening shift, rotational shift workers displayed a more delayed sleep schedule with a wide variation in sleep onset (mean: 19:27 with SD ±13:37), suggesting inconsistent sleep timing, possibly due to irregular shift patterns or pre-sleep activities. Despite sleeping slightly longer than in rotational shift workers during morning shift(mean: 6:57), alarm use was lower (49%), indicating slightly more autonomy in wake-up time, though their sleep timing still may not be optimal (Vetter et al., 2015).

During night shift, rotational shift workers had the most significantly delayed sleep onset (mean: 10:26) and wake-up time (15:46), with the shortest sleep duration of just 5 hours and 19 minutes. This reflects the chronic sleep deprivation often associated with night shifts, likely due to circadian misalignment and light exposure during typical rest times (Akerstedt et al., 2003). Alarm use was moderate (57%), but insufficient sleep duration suggests that many workers wake up before obtaining restorative sleep, possibly due to social or family obligations.

On free days, across all workers, the sleep duration increased significantly to a mean of 8 hours and 32 minutes, with a mid-sleep time of 3:19 and alarm use dropping to 26%. This extended rest suggests that workers experience sleep compensation, a known marker of sleep debt during workdays (Roenneberg et al., 2007). These findings emphasize the impact of shift work on sleep quantity and quality, and the need for shift design that considers circadian biology.

Overall, the data supports previous research indicating that rotational and night shift work leads to disrupted sleep patterns, reduced sleep duration, and higher sleep debt (Kecklund & Axelsson, 2016). These sleep disruptions may in turn affect metabolic health, performance, and overall well-being.

Table 4.5.2 – Key Sleep Metrics Assessment among Shift workers

	Social Jetlag (hh:mm)	**Sleep Debt (hh: mm)**	**Social Jetlag - Adjusted Chronotype (hh: mm)**
Workdays	**Mean ± SD**	**(Median)**	
Morning	1:14 ± 0:58	1:24 ± 1:05	3:19 ± 1:15
(Median)	(01:00)	(01:15)	(03:15)
Evening	0:49 ± 3:34	1:37 ± 1:31	0:56 ± 0:20
(Median)	(00:03)	(01:15)	(01:03)
Night	0:24 ± 0:05	2:46 ± 1:44	3:27 ± 1:03
(Median)	(00:24)	(02:45)	(03:26)
Free day	-	-	-

Table 4.5.2 presents data on social jetlag, sleep debt, and social jetlag adjusted for chronotype for different work schedules (Morning, Evening, and Night shifts).

Social Jetlag: Social jetlag represents the difference in mid-sleep time between workdays and free days, indicating a misalignment between biological and social clocks.

Social Jetlag Adjusted for Chronotype: It refers to mid-point of sleep corrected for sleep debt provides a measure of an individual's sleep-wake preference.

During morning shift, rotational shift workers experienced the highest level of social jetlag, averaging 1 hour and 14 minutes, which indicates a notable misalignment between their biological clock and work schedule. Although this group had moderate sleep debt (1:24), their adjusted chronotype was 3:19, suggesting a stable morning orientation. The high social jetlag in this group likely results from early work start times conflicting with the natural sleep-wake cycle (Roenneberg et al., 2007).

In contrast, during evening shift, rotational shift workers reported lower social jetlag (mean: 0:49), indicating better alignment of work and biological schedules. However, their sleep debt was higher (1:37), suggesting that despite more flexible sleep timing, they still experience insufficient sleep—possibly due to prolonged wakefulness or inconsistent routines. Their adjusted chronotype (0:56) reflects a much earlier midpoint, likely skewed by irregular schedules or inadequate rest.

During night shift, rotational shift workers displayed the lowest social jetlag (0:24), likely because their schedules are drastically shifted and free days may still follow a delayed sleep cycle. However, this group reported the highest sleep debt (2:46), confirming that night shifts are particularly detrimental to total sleep duration. Their adjusted chronotype (3:27) aligns with an extreme evening or delayed type, consistent with research suggesting that chronic night shift work disrupts circadian rhythms and leads to long-term sleep disturbances (Vetter et al., 2015; Kecklund & Axelsson, 2016).

The comparison across groups underscores a trade-off between circadian alignment and sleep quantity, where less social jetlag doesn't necessarily mean better sleep health. Especially in night shift workers, lower jetlag coexist with poor sleep duration, possibly contributing to adverse metabolic and psychological outcomes (Wittmann et al., 2006; Akerstedt et al., 2003).

Table 4.5.3 – Association of Sleep Debt Across Shift Types:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
Morning vs Evening	0.0585 ± 0.046 vs. 0.067 ± 0.064	0.24	No significant difference
Morning vs Night	0.067 ± 0.064 vs. 0.115 ± 0.073	0.00 (4.8E-07)	Significant difference
Evening vs Night	0.058 ± 0.046 vs. 0.115 ± 0.073	0.00 (7.9E-11)	Significant difference

Table 4.5.3 summarizes the mean sleep debt values across shift groups, along with standard deviations and statistical comparisons. Sleep debt refers to the shortfall between the amount of sleep an individual needs and what they obtain, and it is recognized as a key indicator of circadian strain and sleep-related health risk (Van Dongen et al., 2003). There was no significant difference in sleep debt between Morning and Evening shift in rotational shift workers. This suggests that both groups were similarly successful—or challenged—in meeting their sleep requirements, potentially due to their alignment with more

socially conventional schedules that allow for consistent sleep routines (Wittmann et al., 2006).

During night shift, rotational shift workers demonstrated substantially higher sleep debt, consistent with prior findings that night shifts disrupt circadian rhythms and reduce sleep quantity and quality due to daytime sleep being less restorative (Foster & Wulff, 2005; Åkerstedt, 2003). Similarly, during night shift, workers had significantly higher sleep debt compared to these workers during evening shifts. The elevated sleep debt among these workers during night shift is concerning, as chronic sleep debt is associated with a range of adverse outcomes, including impaired cognitive performance, increased risk of chronic diseases, and reduced psychological well-being (Van Dongen et al., 2003; Wright et al., 2013).

Table 4.5.4 – Association of Sleep Debt across Shift Types with Age:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
Sleep Debt (M) vs Age	0.058 ± 0.046 vs. 0.067 ± 0.064	0.072	No significant difference
Sleep Debt (E) vs Age	0.0674 ± 0.064 vs. 0.115 ± 0.073	0.000	Significant difference
Sleep Debt (N) vs Age	0.058 ± 0.046 vs. 0.115 ± 0.073	0.187	No significant difference

Here M – Morning, E – Evening , N – Night

Table 4.5.4 summarizes the statistical comparisons between sleep debt and age within each shift group. The comparison of sleep debt in Morning shift workers against age yielded no statistically significant relationship. This suggests that among rotational shift workers during morning shift, age does not significantly affect the accumulation of sleep debt. This might be due to the alignment of the Morning shift with the natural circadian rhythm, which tends to favor earlier sleep and wake times as individuals age (Roenneberg et al., 2007).

Hence, older adults working morning shifts may not experience the same level of sleep strain compared to those on later shifts.

A significant difference was found between sleep debt and age among these workers during evening shift, indicating that age is a relevant factor affecting sleep debt in this group. The physiological decline in sleep efficiency with age, coupled with misalignment of circadian preferences in evening shifts, may contribute to increased sleep difficulties in older individuals (Duffy et al., 2015). Older adults are more prone to early awakenings and lighter sleep, making evening shifts particularly challenging. While night shifts inherently induce higher sleep debt due to circadian misalignment, this effect appears to be consistent across age groups in the present sample. This aligns with prior findings suggesting that night work disrupts sleep across all ages, although the strategies used to cope may vary (Åkerstedt & Wright, 2009).

Table 4.5.5 – Association of Sleep Debt across Shift Types with Commuting Time:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
SDebt (M) vs Commute Time	0.058 ± 0.046 vs. 0.067 ± 0.064	0.001	Significant difference
SDebt (E) vs Commute Time	0.067 ± 0.064 vs. 0.116 ± 0.073	0.024	Significant difference
SDebt (N) vs Commute Time	0.058 ± 0.046 vs. 0.116 ± 0.073	0.381	No significant difference

Here, SDebt stands for Sleep Debt

Table 4.5.5 shows that there was a significant difference between sleep debt and commuting time among Morning shift workers ($p = 0.0018$). This finding suggests that longer commuting durations are associated with increased sleep debt in this group. Morning shifts typically require early start times, which can force individuals to wake earlier than their natural sleep preference allows, especially when compounded by lengthy commutes (Basner et al., 2007).

Although evening shifts may allow for later wake times, extended commutes—especially in congested evening traffic—could interfere with sleep timing and reduce the available sleep window before subsequent shifts. Additionally, individuals working evening shifts may experience social and family obligations during the day, further limiting recovery sleep (Folkard & Tucker, 2003).

Conversely, no significant association was observed between commuting time and sleep debt in Night shift workers. One possible explanation is that night shift workers, who often sleep during the daytime, may have more flexibility in scheduling sleep and commuting. Alternatively, the sleep debt experienced by this group could already be significantly impacted by circadian misalignment, such that additional commute-related variations exert a comparatively minor influence (Åkerstedt, 2003).

Table 4.5.6 – Association of Sleep Duration between Shift Types and Free Day:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
Morning Shift vs Free Day	0.279 ± 0.053 vs. 0.356 ± 0.071	5.64E-17	Significant difference
Evening Shift vs Free Day	0.289 ± 0.124 vs. 0.356 ± 0.071	1.84E-06	Significant difference
Night Shift vs Free Day	0.222 ± 0.085 vs. 0.356 ± 0.071	5.23E-23	Significant difference

Table 4.5.6. data reveal that morning shift workers had significantly shorter sleep duration compared to free days. Similarly, individuals working evening shifts also experienced significantly less sleep than on their free days. These findings suggest a clear trend of reduced sleep on

working days regardless of shift type, and an increase in sleep duration on non-working or free days. This pattern is consistent with existing literature, which shows that work-related time constraints and early start times can significantly reduce total sleep duration, especially among shift workers (Åkerstedt et al., 2000; Boivin & Boudreau, 2014). The extended sleep on free days is often seen as a compensatory response to accumulated sleep debt.(Wittmann et al., 2006).The larger difference in sleep duration between evening shifts and free days suggests that evening shifts may be particularly disruptive to sleep. This could be due to a misalignment between the individual's circadian rhythm and actual sleep opportunity, as evening shifts often delay bedtime while early obligations the next day can shorten sleep duration (Barber & Munz, 2011).

Table 4.5.7 – Association of Social Jetlag(SJL) across Shift types with Age:

Comparison	**Mean ± SD**	**p-value (two-tailed)**	**Significance**
SJL(M) vs Age	0.28 ± 0.05 vs. 0.40 ± 0.07	0.259	No significant difference
SJL(E) vs Age	0.30 ± 0.12 vs. 0.36 ± 0.07	0.456	No significant difference
SJL(N) vs Age	0.20 ± 0.09 vs. 0.40 ± 0.07	0.000	Significant difference

Here N-Night shift, E- Evening Shift, M- Morning Shift

Table 4.5.7 presents the comparison between morning shift workers and age did not show a significant difference, nor did the comparison for evening shift workers. However, a statistically significant difference was observed in night shift workers when compared with age. This significant result in the night shift group may suggest that older individuals experience less social jetlag while working night shifts, possibly due to greater adaptation or stabilization of sleep-wake cycles over time. Alternatively, it could reflect a selection effect, where only those individuals who can tolerate or adapt to night shifts continue in such roles as they age. In contrast, younger individuals may experience more pronounced social jetlag due to biological tendencies toward delayed sleep timing (Roenneberg et al., 2007).

Table 4.5.8 - Association of Social Jetlag(SJL) across Shift types with Chronotype:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
SJL (M) vs Chronotype	0.30 ± 0.05 vs. 0.36 ± 0.06	0.000	Significant difference
SJL (E) vs Chronotype	0.28 ± 0.12 vs. 0.36 ± 0.06	0.228	No significant difference
SJL (N) vs Chronotype	0.22 ± 0.09 vs. 0.35 ± 0.06	0.035	Marginally significant difference

Here N-Night shift, E- Evening Shift, M- Morning Shift

Table 4.5.8. presents social jetlag comparison across shift type with chronotype shows a significant difference was observed between morning shift workers and their chronotype, that individuals with misaligned chronotypes—likely evening types working morning shifts—experience higher levels of social jetlag. This finding is consistent with prior studies demonstrating that morning shifts tend to be more misaligned with the natural circadian rhythms of evening chronotypes, resulting in greater SJL (Wittmann et al., 2006; Roenneberg et al., 2007). In these individuals, waking up earlier than their biological preference can lead to sleep deprivation on workdays and compensation on free days, thereby increasing SJL.

For evening shift workers, no significant difference was found between SJL and chronotype suggesting that evening shifts may better align with a broader range of chronotypes, possibly minimizing SJL. Interestingly, the comparison for night shift workers revealed a marginally significant difference. While this indicates some level of misalignment, it may reflect partial adaptation of certain chronotypes to night shifts, or an ability to shift their circadian phase with more flexibility (Pilcher et al., 2000).

These results underscore the importance of considering chronotype in shift scheduling, as misalignment between biological timing and work demands can negatively impact sleep patterns, increase social jetlag, and potentially impair long-term health outcomes (Kantermann et al., 2010).

Table 4.5.9 – Association of Chrono disruption across Shift types with Age:

Comparison	Mean ± SD	p-value (two-tailed)	Significance
Chrono-disruption (M) vs Age	0.279 ± 0.053 vs. 0.356 ± 0.069	0.057	No significant difference
Chrono-disruption (E) vs Age	0.289 ± 0.123 vs. 0.356 ± 0.069	0.380	No significant difference
Chrono-disruption (N) vs Age	0.22 ± 0.085 vs. 0.356 ± 0.069	0.030	Significant difference

Here N-Night shift, E- Evening Shift, M- Morning Shift

Table 4.5.9 presents the comparison of Chronodisruption across different shift types with age, revealing differential impacts depending on the shift schedule. Chronodisruption refers to a misalignment between an individual's internal circadian rhythm and external demands, often resulting in adverse health outcomes (Wittmann et al., 2006; Roenneberg et al., 2007).

There was no statistically significant difference found between chrono-disruption in morning shift workers and age as well as evening shift workers and age .These results suggest that chrono-disruption in these groups may not be strongly age-dependent, potentially due to individual differences in adaptability or lifestyle behaviors that buffer the circadian misalignment.

However, a significant difference was observed in night shift workers compared to age. This indicates that older individuals working night shifts experience greater chronodisruption, possibly due to the reduced plasticity of the circadian system with age (Monk & Buysse, 2013).

Age-related declines in the amplitude and stability of circadian rhythms may make it more difficult for older adults to adjust to night shifts, leading to greater physiological misalignment (Duffy et al., 2015).This finding aligns with prior evidence suggesting that older shift workers report greater sleep disturbances, increased fatigue, and decreased tolerance for night shifts (Åkerstedt, 2003).

Table 4.5.10– Association of Chrono disruption across Shift types with Sleep Duration on Free Day:

Comparison	**Mean ± SD**	**p-value (two-tailed)**	**Significance**
Chrono-disruption (M) vs SD (F)	0.279 ± 0.053 vs. 0.356 ± 0.069	0.424	No significant effect
Chrono-disruption (E) vs SD (F)	0.289 ± 0.123 vs. 0.356 ± 0.069	0.033	Positive association
Chrono-disruption (N) vs SD (F)	0.223 ± 0.085 vs. 0.356 ± 0.069	0.344	No significant effect

Here N-Night shift, E- Evening Shift, M- Morning Shift, F- Freeday

Table 4.5.10 shows the chronodisruption across different shift types with Sleep duration on free days(F).Among morning shift workers, no significant association was found between chronodisruption and sleep duration on free days (p = 0.4248). This may suggest that individuals working morning shifts are more likely to maintain a relatively consistent sleep schedule even on free days, thereby experiencing minimal circadian misalignment.

Similarly, for night shift workers, the relationship between chronodisruption and sleep duration on free days was not statistically significant ($p = 0.3441$). One possible explanation is that night workers often experience persistent circadian disruption regardless of compensatory sleep on off days, as their internal clocks are chronically desynchronized due to nighttime activity (Zhang et al., 2020).

However, a significant positive association was found among evening shift workers ($p = 0.0336$), indicating that longer sleep durations on free days were associated with higher levels of chronodisruption. This finding is consistent with the concept of "social jetlag," wherein individuals attempt to compensate for weekday sleep deprivation or misaligned schedules by sleeping more on free days, which in turn amplifies circadian desynchrony (Wittmann et al., 2006). Evening shifts often lead to inconsistent sleep timing due to late work hours and social engagements, making these workers more prone to greater variability between workdays and free days (Roenneberg et al., 2007).

Section 4.6 – Perceived Stress Levels

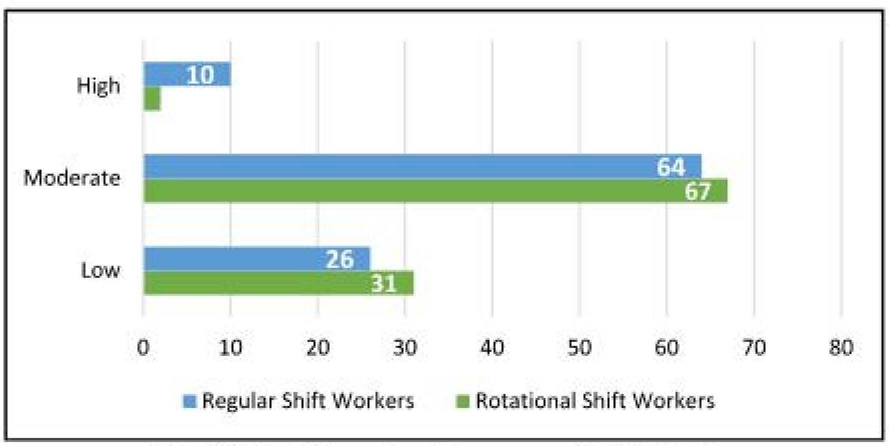

Fig 4.6.1 – Stress levels among Shift Workers

Stress levels showed variations between the groups, with a majority of both reporting moderate stress (67% in rotational and 64% in regular shift workers).This finding aligns with existing literature suggesting that moderate stress is prevalent among shift workers due to irregular schedules, circadian misalignment, and work-life imbalance (Åkerstedt, 2003; Folkard & Tucker, 2003).

Interestingly, a higher percentage of regular shift workers (10%) reported high stress compared to only 2% of rotational shift workers. This could be attributed to better coping mechanisms or adaptation over time to rotating schedules in some individuals. Alternatively, the variety offered by rotational shifts may be perceived as less monotonous(Costa, 2003). Although a slightly higher percentage of rotational workers are in the "low stress" category (31%), than the regular shift workers, their overall stress burden remains significant.

Section 4.7 – Quality of Sleep

Fig. 4.7.1 – Quality of Sleep among both types of Shift workers

Figure 4.7.1 depicts the sleep quality among the regular and rotational shift workers. Many of the participants (78% of rotational shift workers and 56% of the regular shift workers) reported poor sleep quality. A higher percentage of regular shift workers (44%) had good sleep quality, while only 22% of rotational shift workers reported the same. This suggests that rotational shift workers struggle more with sleep disruption, likely due to irregular and inconsistent sleep schedules. These findings highlight the negative impact of shift rotation on sleep health, which can lead to fatigue, reduced productivity, and health issues. These findings suggest a substantial negative impact of rotational shift work on sleep quality, likely due to the disruption of circadian rhythms and frequent changes in sleep-wake schedules. Rotating shifts often prevent the body from establishing a stable sleep routine, leading to chronic sleep disturbances, reduced sleep duration, and decreased sleep efficiency (Boivin & Boudreau, 2014; Akerstedt, 2003).

These findings are consistent with prior research that links rotating shifts to higher risks of insomnia, poor sleep quality, and circadian misalignment (Wright et al., 2013). Moreover, poor sleep quality has been shown to impair cognitive function, reduce productivity, and increase the risk of chronic health conditions, underlining the need for interventions such as sleep hygiene education, strategic napping, and optimized shift scheduling (Caruso, 2014).

Table 4.7.2 Association of Quality of Sleep with Stress Level among both types of Shift Workers:

Shift Type	**Variable**	**p-value (two-tailed)**	**Significance**
Regular Shift Workers	Stress	< 0.0001	No significant difference
	Sleep Quality	0.7069	
Rotational Shift Workers	Stress	0.0008	Significant difference
	Sleep Quality	0.0306	

Table 4.7.2 presents the relationship between sleep quality and stress levels among shift workers, revealing distinct patterns between rotational and regular shift schedules. For rotational shift workers, both stress and sleep quality were found to be significantly associated, indicating that higher stress levels are likely linked to poorer sleep outcomes in this group. These findings align with existing research suggesting that rotational shift workers are particularly vulnerable to sleep disturbances due to frequent disruptions in their circadian rhythm and increased psychological strain (Boivin & Boudreau, 2014; Caruso, 2014). Irregular and unpredictable work hours inherent in rotational shifts can impair the body's natural sleep-wake cycle, contributing not

only to poor sleep quality but also to heightened perceived stress (Akerstedt, 2003). The dual burden of stress and poor sleep may further exacerbate the risk of long-term physical and mental health issues among these workers (Wright et al., 2013).

In contrast, among regular shift workers, although stress was statistically significant, sleep quality did not show a significant association. This may suggest that individuals on a fixed shift schedule-regardless of whether it is morning, evening, or night-may be better able to develop coping strategies or adjust physiologically over time, thereby reducing the impact of work-related stress on sleep. Alternatively, it could reflect a threshold effect, where chronic exposure to a fixed schedule leads to adaptation that blunts the sleep-related consequences of stress (Kecklund & Axelsson, 2016).

Section 4.8 - Physical Activity Level

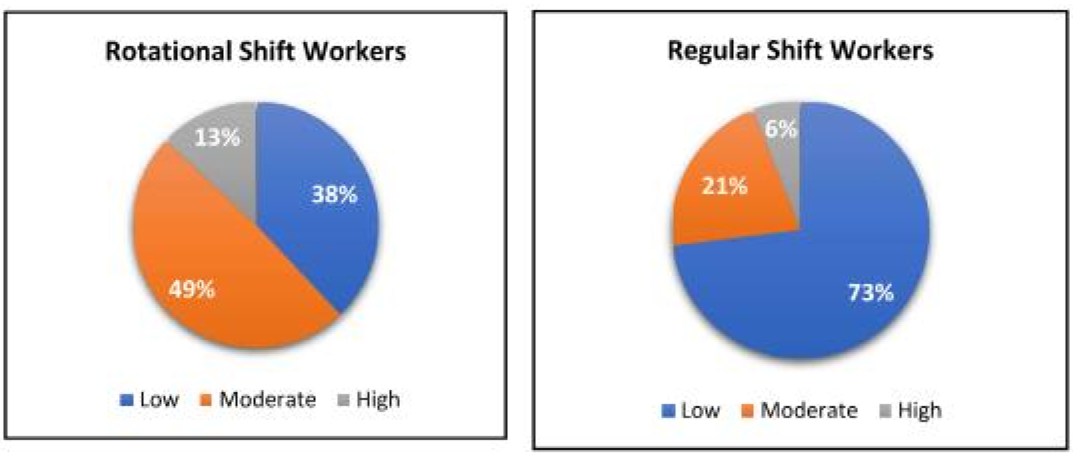

Fig. 4.8 – Physical activity levels among Shift Workers

A greater proportion of rotational shift workers (49%) engaged in moderate physical activity compared to regular shift workers (21%). Similarly, high physical activity levels were more common among rotational shift workers (13%) than regular shift workers (6%). However, a significantly larger percentage of regular shift workers (73%) had low physical activity levels, compared to 38% among rotational shift workers. Rotational shift workers are more physically active than regular shift workers, due to varying job demands and irregular schedules that involve movement. Regular shift workers have a significantly higher proportion (73%) in the "Low" activity category, may experience more predictable routines and longer periods of sedentary behavior, contributing to lower overall activity levels (Proper et al., 2011). Only a small percentage of both groups engage in high physical activity (13% in rotational vs. 6% in regular), despite the better activity profile among rotational workers, only a small proportion of both groups engage in high levels of physical activity (13% and 6% respectively), which highlights the overall inactivity trend among shift workers. This reflects the broader challenges shift workers face in maintaining a healthy lifestyle, including fatigue, poor work-life balance, and disrupted circadian rhythms (Atkinson et al., 2008).

Section 4.9 - Sitting Time

Table 4.9.1 Sitting Duration among Shift workers

	Rotational Shift Workers	**Regular Shift Workers**
Sitting Time Risk Category	**N (%)**	**N (%)**
Low	19(19)	32(32)
Medium	63(63)	52(52)
High	15(15)	13(13)
Very High	3(3)	3(3)

Table 4.9.1 presents the data sitting duration among the rotational and regular shift workers. The data reveal similar distributions of sitting time across both groups, with the majority of workers falling into the "Medium" risk category (63% for rotational shift workers and 52% for regular shift workers). The percentage of workers in the "Very High" sitting risk category was low in both groups (3%). Regular shift workers have a higher proportion (32%) in the "Low" sitting time

category, meaning they might have better movement opportunities than rotational workers. Rotational shift workers have a higher proportion (63%) in the "Medium" risk category, suggesting longer sedentary periods, potentially due to shift demands despite of being more moderately physically active compared to regular shift workers, sitting duration leads to medium risk, potentially harming health and raising health concerns.

Both groups have similar percentages in the "High" (15% vs. 13%) and "Very High" (3% each) categories, indicating sitting for long hours is a major concern across both work types. The increased prevalence of medium to high sitting risk among rotational shift workers may seem counterintuitive, given their previously discussed higher physical activity levels. However, this contrast suggests that while rotational workers may engage in bursts of physical activity during shifts, they may also accumulate prolonged periods of sitting, particularly during off-duty hours or between shift rotations when recovery is needed (Gupta et al., 2017). Shift patterns that include extended rest or standby periods can contribute to this sedentary accumulation (Luan et al., 2020).Extended sitting time is independently associated with numerous adverse health outcomes, including metabolic syndrome, cardiovascular disease, obesity, and all-cause mortality, even after adjusting for physical activity levels (Dunstan et al., 2012; Owen et al., 2010).

Fig.4.10(a) and (b) present the screen time duration during weekdays, weeknights, weekends among both type of shift workers. During weekdays, a higher percentage of rotational shift workers (40%) had moderate screen time compared to regular shift workers (26%). However, a greater proportion of regular shift workers had very high screen time on weekdays (26%) compared to rotational shift workers (11%). On weekends, both groups had a higher prevalence of "Very High" screen time (36% for rotational shift workers and 37% for regular shift workers), indicating increased recreational screen usage during non-working days.

Screen Time During Weekdays: Regular shift workers have a higher percentage of very high screen time (26%) compared to rotational workers (11%), while rotational workers tend to fall more in the moderate screen time category (40%).

Section 4.10- Screen Time Assessment

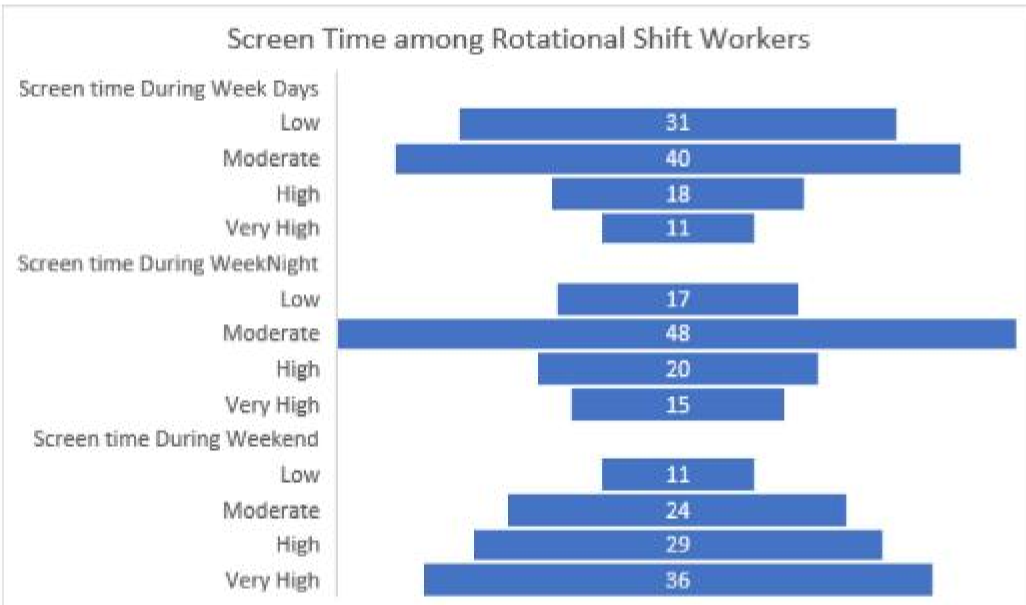

Fig 4.10(a) – Screentime duration of Rotational Shift worker

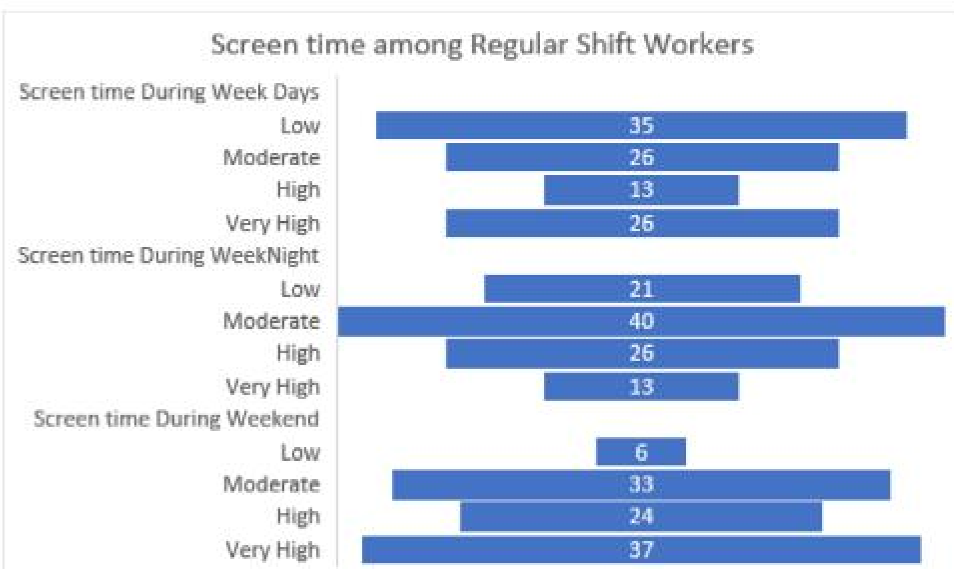

Fig 4.10(b) – Screentime duration of Regular Shift worker

Screen Time During Weeknights: Rotational shift workers tend to spend more screen time at night (48% moderate, 20% high) compared to regular shift workers, who have slightly lower engagement. This could be due to increased screen exposure during night shifts, affecting sleep quality and circadian rhythms.

Screen Time During Weekends: Both groups exhibit very high screen time usage during weekends (~36-37%). This suggests a general trend of increased leisure screen time on non-working days.

These results suggest that both rotational and regular shift workers are experiencing elevated screen time, especially during the weekend, when traditional work pressures may be reduced. Notably, rotational shift workers appear to have more variability across the week, which may reflect the irregularity of their schedules and the likelihood of screen-based leisure activities being used to manage stress or unwind after shifts. High screen time, particularly during evening or night hours, has been associated with disruptions in sleep patterns, delayed sleep onset, and circadian rhythm disturbances (Chang et al., 2015; Exelmans & Van den Bulck, 2016). Moreover, extended screen exposure especially at night can negatively impact melatonin secretion and sleep quality, which is a concern for shift workers already prone to circadian disruption (Wright et al., 2013).

Table 4.11.1 presents the association between chronotype categories—Moderate Evening, Intermediate, Moderate Morning, and Definite Morning types-and various dietary intake parameters in rotational shift workers. The results demonstrated statistically significant variations in multiple dietary components across different chronotypes.

Section 4.11 – Association of Dietary Intake with Chronotype among Shift Workers

Table 4.11.1 Association of Chronotype Categories and Dietary Intake of Rotational Shift Workers

Parameters(g/ml)	Moderate Evening	Intermediate	Moderate Morning	Definite Morning
p values				
Total Calorie Intake (kcal)	0.046	2.14E-06	1.28E-17	6.18E-14
Total Carbohydrate	0.126	0.00	2.20E-08	0.00
Total Protein	0.021	3.95E-10	1.21E-29	5.35E-29
Total Fat	0.078	3.26E-07	2.27E-24	1.14E-26
Total Fiber	0.114	2.17E-17	2.67E-61	2.13E-61
Consumption of Cereals	0.010	5.26E-07	5.75E-28	4.90E-27
Consumption of Pulses and Legumes	0.204	6.32E-05	3.13E-13	1.38E-12
Consumption of Green Leafy Vegetables	0.182	0.002	1.20E-13	1.94E-13
Consumption of Roots and Tuber	0.132	2.01E-06	1.22E-16	6.12E-16
Consumption of Other Vegetables	0.230	0.503	0.00	7.66E-13
Consumption of Fruits	0.177	0.001	1.31E-06	0.00
Consumption of Milk and Milk Products	0.403	0.00	2.94E-19	2.74E-15
Consumption of Fats and Oils	0.166	5.74E-07	2.712E-20	2.15E-20
Consumption of Nuts and Seeds	0.008	2.79E-06	0.929	1.68E-16
Consumption of Sugar	0.298	0.0001	0.0001	2.49E-06

1. Total Calorie, Macronutrient, and Fiber Intake

Participants with Definite Morning and Moderate Morning chronotypes had significantly lower p-values for total calorie intake ($p = 6.18\times10^{-14}$ and $p = 1.29\times10^{-17}$, respectively), indicating a strong association between morningness and energy intake. Similarly, total carbohydrate, protein, and fat intake was also highly associated with morning chronotypes, especially the Moderate Morning and Definite Morning types (all $p < 0.001$).

Fiber intake followed the same pattern, with the strongest association observed in morning types ($p = 2.13\times10^{-61}$ for Definite Morning). These findings suggest that individuals with a morning preference tend to have healthier and more consistent eating patterns, possibly aligning better with circadian rhythms.

This aligns with findings by Kantermann and Roenneberg (2009), who noted that individuals with earlier chronotypes typically consume more balanced diets and eat meals earlier in the day, which corresponds with more optimal metabolic regulation.

2. Consumption of Food Groups

Consumption of cereals, pulses and legumes, green leafy vegetables, roots and tubers, fruits, and milk products was significantly higher in morning chronotypes (all $p < 0.001$), showing that these individuals were more likely to consume nutrient-dense, wholesome food items.

For instance:

- Cereal consumption was most strongly associated with Moderate Morning ($p = 5.75\times10^{-28}$).
- Pulse and legume intake was also significantly associated with both Moderate and Definite Morning groups.

- Fruit and vegetable intake, especially green leafy vegetables, had p-values as low as 1.94×10^{-13} in Definite Morning types, showing a distinct trend of healthier dietary choices among early chronotypes.

  This could be attributed to better adherence to structured meal timings and greater dietary awareness in morning types. Wirth et al. (2014) also found similar trends, where morning chronotypes had healthier dietary habits compared to evening chronotypes.

3. Discretionary Food Intake

Interestingly, sugar and fat intake, though significant across all groups, showed higher association values for Intermediate and Moderate Morning types, hinting at some variability in less healthy food consumption patterns even among early chronotypes.

Nuts and seeds consumption did not show a strong association with chronotype in the Moderate Morning group ($p = 0.93$), suggesting that this food group may be consumed uniformly regardless of circadian preference.

Table 4.11.2 Association of Chronotype Categories and Dietary Intake of Regular Shift Workers

Parameters(g/ml)	Moderate Evening	Intermediate	Moderate Morning	Definite Morning
p values				
Total Calorie Intake (kcal)	0	1.11E-08	1.64E-33	3.75E-22
Total Carbohydrate	0	6.78E-08	1.94E-33	3.54E-21
Total Protein	0	5.91E-06	1.11E-19	1.55E-11
Total Fat	0	8.23E-07	2.68E-17	3.28E-10
Total Fiber	0	0.006	1.21E-05	9.45E-06
Consumption of Cereals	0	4.18E-07	1.10E-30	8.28E-20
Consumption of Pulses and Legumes	0	1.40E-06	4.22E-14	3.19E-10
Consumption of Green Leafy Vegetables	0	7.15E-15	2.21E-42	7.63E-36
Consumption of Roots and Tuber	0	0.00	3.72E-18	3.14E-14
Consumption of Other Vegetables	0	0.90	1.43E-07	1.91E-11
Consumption of Fruits	0	0.037	7.42E-05	0.00
Consumption of Milk and Milk Products	0	3.67E-06	2.44E-17	4.71E-18
Consumption of Fats and Oil	0	1.24E-08	3.17E-21	1.21E-16
Consumption of Nuts and Seeds	0	0.00	7.08E-67	5.96E-29
Consumption of Sugar	0	3.23E-05	1.38E-05	2.45E-07

Table 4.11.2 presents the association between chronotype categories—Moderate Evening, Intermediate, Moderate Morning, and Definite Morning types—and the dietary intake patterns among regular shift workers, based on p-values reflecting statistical significance.

1. Macronutrient Intake

A highly significant association was observed between chronotype and total calorie intake, particularly among the Moderate Morning ($p = 1.64\times10^{-33}$) and Definite Morning types ($p = 3.76\times10^{-22}$). Similar trends were noted for carbohydrates, protein, and fat intake, with p-values indicating strong statistical significance for morning chronotypes:

- Carbohydrates: Moderate Morning ($p = 1.94\times10^{-33}$), Definite Morning ($p = 3.54\times10^{-21}$)
- Protein: Moderate Morning ($p = 1.11\times10^{-19}$), Definite Morning ($p = 1.55\times10^{-11}$)
- Fat: Moderate Morning ($p = 2.68\times10^{-17}$), Definite Morning ($p = 3.29\times10^{-10}$)

This trend suggests that morning chronotypes, particularly Moderate and Definite Morning types, follow more structured eating patterns, possibly due to better alignment with circadian rhythms. Studies have reported that early chronotypes tend to maintain consistent meal timings and make more balanced food choices (Roenneberg et al., 2012; Wirth et al., 2014).

2. Fiber Intake

Although the Moderate Evening group showed no significant association ($p = 0$), other chronotypes, especially Moderate Morning ($p = 1.21\times10^{-5}$) and Definite Morning ($p = 9.45\times10^{-6}$), showed significant associations with fiber intake, implying that individuals with early chronotypes may be consuming more fibrous food sources, likely due to healthier food preferences.

3. Consumption of Core Food Groups

The intake of cereals, pulses, green leafy vegetables, fruits, and milk showed highly significant associations with morning chronotypes, particularly:

- Cereals: Moderate Morning ($p = 1.10\times10^{-30}$)
- Green leafy vegetables: Moderate Morning ($p = 2.21\times10^{-42}$), Definite Morning ($p = 7.63\times10^{-36}$)
- Pulses and legumes: Moderate Morning ($p = 4.22\times10^{-14}$)
- Milk and dairy: Moderate Morning ($p = 2.44\times10^{-17}$)

Such food items are often linked to higher diet quality and micronutrient sufficiency. The results are consistent with the findings of Lucassen et al. (2013), who emphasized that morning types are more likely to consume nutrient-dense diets due to routine and earlier meal timing.

4. Roots, Tubers, and Vegetables

The intake of roots and tubers and other vegetables was significantly associated with morning chronotypes (e.g., $p = 3.72\times10^{-18}$ for Moderate Morning), while Moderate Evening types again showed no significant association, indicating their lower consumption or inconsistent eating patterns.

Interestingly, other vegetable intake showed minimal association with the Intermediate group ($p = 0.90$), suggesting less variation in intake across non-morning types.

5. Discretionary Foods

Even in the case of discretionary foods like:

- Sugar ($p = 1.38\times10^{-5}$ for Moderate Morning)
- Fats and oils ($p = 3.18\times10^{-21}$)
- Nuts and seeds ($p = 7.08\times10^{-67}$)

significant associations were found for Moderate and Definite Morning types. This may reflect a better-regulated intake of fats and added sugars among early chronotypes. However, the significant results might also point toward controlled consumption rather than elimination, hinting at awareness and moderation.

Section 4.12 – Chrono-nutrition Profile of Shift Workers

Table 4.12.1 – Chrono-nutrition Profile of Shift Workers

Chrono-nutrition Profile	Rotational Shift Workers	Regular Shift Workers
	N(%)	N(%)
Good	4 (4)	9 (9)
Fair	30 (30)	47 (47)
Poor	66(66)	43 (43)

Table 4.12.1 shows that of about 66% of rotational shift workers has poor chrono-nutrition profile as compared to regular shift workers being 43%.This indicates that many rotational shift workers having night eating, breakfast skipping ,having dinner as largest meal as compared to regular shift workers having lunch as largest meal of the day, less meal skipping.

Table 4.12.2 Association of Chrono-nutrition profile and BMI

BMI Classification	Rotational Shift Workers	Regular Shift Workers
p value*		
Underweight	4.75E-11	5.8E-12
Normal	5.56E-50	1.01E-43
Overweight	1.78E-17	2.26E-20
Obese	8.6E-43	8.2E-60

p-value is based on an Independent t-test analysis

*p-value <0.05 is considered to be a significant level

This table presents the statistical association between BMI classifications and the chrono-nutrition profile among rotational and regular shift workers, with p-values highlighting the strength of these relationships across different BMI categories: normal, overweight, obese, and underweight.

1. Underweight Category

Interestingly, underweight status was significantly associated with chrono-nutrition profiles in both groups—rotational ($p = 4.75\times10^{-11}$) and regular ($p = 5.8\times10^{-12}$). This might suggest that not only excessive calorie intake but also irregular and insufficient intake linked to circadian disruption contributes to poor nutritional status at both ends of the weight spectrum. Studies have shown that circadian misalignment can lead to appetite suppression, poor digestion, or unintentional fasting in some individuals, contributing to underweight status (Taheri & Arabameri, 2012).

2. Normal BMI

Among both rotational shift workers ($p = 5.56\times10^{-50}$) and regular shift workers ($p = 1.01\times10^{-43}$), individuals with normal BMI showed highly significant associations with their chrono-nutrition profiles. This suggests that individuals maintaining a normal BMI likely have better-aligned eating and sleeping schedules, which are more consistent with their internal circadian rhythms. Prior research supports this connection; individuals with better circadian alignment tend to maintain healthier body weights and better metabolic regulation (Roenneberg et al., 2012; Garaulet & Gómez-Abellán, 2014).

3. Overweight Category

The overweight category also demonstrated strong associations—$p = 1.78\times10^{-17}$ for rotational and $p = 2.26\times10^{-20}$ for regular shift workers. These values support the hypothesis that even a modest deviation from normal BMI may be influenced by disrupted chrono-nutritional behaviors and irregular schedules.

4. Obese Category

The association between chrono-nutrition and obesity was also extremely significant in both groups—rotational ($p = 8.6 \times 10^{-43}$) and regular ($p = 8.2 \times 10^{-60}$) workers. This finding indicates that disrupted chrono-nutritional behaviors (e.g., irregular meal timing, eating late at night, or skipping breakfast) may be strongly linked to increased obesity risk, regardless of shift pattern. Shift work, particularly when coupled with circadian misalignment, has been consistently associated with higher BMI and obesity due to altered hormonal regulation and metabolism (Antunes et al., 2010; Spiegel et al., 2004).

Overall, all BMI categories demonstrated statistically significant associations with chrono-nutritional profiles in both shift groups. However, the p-values were even stronger among regular shift workers for obesity and overweight status, possibly suggesting that even without rotating schedules, poor chrono-nutritional habits (e.g., eating late, skipping meals) can still cause misalignment and weight gain. Conversely, rotational shift workers may face more variability in meal timing and quality, potentially contributing to extremes like underweight or obesity.

These findings align with the chronobiological framework, which emphasizes the importance of eating in synchrony with the body's internal clock. Misalignment between internal circadian rhythms and behavioral cycles (like eating and sleeping) is now widely recognized as a risk factor for metabolic disturbances and weight abnormalities (Pot et al., 2016; Jakubowicz et al., 2013).

Table 4.12.3 Association of Chrono-nutrition profile and Body Composition of Shift Workers

Table 4.12.3(a) - Association of Chrono-nutrition profile and Body Fat distribution among Shift Workers

Total Body Fat Classification	Rotational Shift Workers	Regular Shift Workers
p value*		
Low	7.9E-24	1.08E-09
Normal	2.32E-37	4.65E-32
High	2.65E-61	3.4E-73
Very High	0.08519	0
p-value is based on an Independent t-test analysis *p-value <0.05 is considered to be a significant level		

This analysis examines the relationship between total body fat percentage classifications and the chrono-nutrition profiles of rotational and regular shift workers, using p-values to determine statistical significance across different fat categories: low, normal, high, and very high.

1. Low Body Fat

The association between low body fat and chrono-nutrition profile was statistically significant for both rotational shift workers ($p = 7.9\times10^{-24}$) and regular shift workers ($p = 1.08\times10^{-9}$). These values indicate that individuals with lower body fat tend to follow more aligned chrono-nutritional behaviors. This may include meal timing that synchronizes better with the body's internal clock (e.g., avoiding late-night eating, regular breakfast consumption), which has been shown to support healthier fat composition (Garaulet et al., 2013).

2. Normal Body Fat

A highly significant association was also observed in those with normal total body fat, with $p = 2.32\times10^{-37}$ for rotational and $p =$

4.65×10^{-32} for regular workers. This further supports the idea that maintaining circadian-consistent eating habits may help preserve a healthy fat percentage. Chrono-nutritional alignment—particularly eating the majority of calories earlier in the day—has been positively associated with better lipid metabolism and reduced fat storage (Jakubowicz et al., 2013).

3. High Body Fat

The high body fat category demonstrated the strongest statistical significance: $p = 2.65 \times 10^{-61}$ for rotational and $p = 3.4 \times 10^{-73}$ for regular shift workers. These findings underscore the profound relationship between poor chrono-nutritional habits and increased body fat percentage. Irregular meal timing, frequent nighttime eating, and social jetlag can contribute to altered hormonal rhythms (e.g., leptin and ghrelin), leading to increased fat accumulation (Roenneberg et al., 2012; Arble et al., 2009).

4. Very High Body Fat

Interestingly, while the regular shift group showed a statistically significant association with very high body fat ($p = 0$), the rotational group did not reach significance ($p = 0.08519$). This may suggest that in regular shifts, consistent yet misaligned dietary habits (e.g., habitual late dinners or skipping breakfast) can still contribute to excessive fat gain. In rotational workers, variability in shift timing might diffuse this effect, or the sample size in the "very high" group may have limited statistical power.

Overall Interpretation

Chrono-nutritional misalignment appears to be a key driver in body fat abnormalities, not only in rotational but also in regular shift workers. The highest levels of significance were consistently found in the high fat category, aligning with existing literature that links disrupted eating patterns and circadian misalignment with increased adiposity, independent of total caloric intake (Almoosawi et al., 2016; Froy, 2010). These findings reinforce the need for chrono-nutrition-based interventions to help mitigate fat accumulation and associated metabolic risks.

Table 4.12.3(b) - Association of Chrono-nutrition profile and Visceral Fat distribution among Shift Workers

Visceral Fat Classification	Rotational Shift Workers	Regular Shift Workers
p value*		
Normal	0.362	0.051
High	2.97E-21	1.05E-30
Very High	4.06E-06	5.32E-16
p-value is based on an Independent t-test analysis *p-value <0.05 is considered to be a significant level		

Table 4.11.3(A) presents the relationship between visceral fat distribution classifications (Normal, High, Very High) and chrono-nutrition profiles among rotational and regular shift workers

1. Normal Visceral Fat

The association between normal visceral fat and chrono-nutrition profile was found to be statistically non-significant for both rotational shift workers ($p = 0.362663$) and regular shift workers ($p = 0.051528$). This indicates that, in individuals with normal visceral fat, chrono-nutrition variables may not play a major differentiating role. It may suggest that some individuals, despite shift work, maintain metabolic stability possibly through compensatory mechanisms like consistent physical activity or better sleep hygiene (Knutsson, 2003).

2. High Visceral Fat

There is a highly significant association observed between high visceral fat levels and chrono-nutrition misalignment in both rotational ($p = 2.97\times10^{-21}$) and regular shift workers ($p = 1.05\times10^{-30}$). This strong significance aligns with prior research indicating that eating during circadian misaligned hours (such as late-night meals common in shift workers) contributes significantly to fat accumulation, particularly visceral fat (Arble et al., 2009; Froy, 2010). Visceral adiposity is closely linked to increased cardiometabolic risk, and chrono-nutritional behaviors such as irregular meal timing, skipping breakfast, and night eating have been implicated in exacerbating this risk.

3. Very High Visceral Fat

Similarly, the very high visceral fat category also showed a significant association for both groups—rotational ($p = 4.06\times10^{-6}$) and regular shift workers ($p = 5.32\times10^{-16}$). These findings suggest that as visceral adiposity increases, the degree of chrono-nutritional disruption becomes more pronounced. A growing body of evidence supports the idea that metabolic consequences of visceral fat are influenced not just by caloric intake but also by *when* food is consumed, especially in relation to internal circadian rhythms (Garaulet et al., 2013; Zimberg et al., 2012).

The findings demonstrate a strong association between elevated visceral fat levels and disrupted chrono-nutrition patterns in both rotational and regular shift workers. Though regular shift workers maintain consistent timing, the alignment of meal timing with their endogenous circadian rhythm may still be poor, leading to negative outcomes similar to rotational shift workers. This supports the hypothesis that chrono-nutritional misalignment is a shared risk factor across all types of shift work, and not just exclusive to rotational shifts.

Table 4.12.3(c) - Association of Chrono-nutrition profile and Skeletal Muscle distribution among Shift Workers

Skeletal Muscle Classification	Rotational Shift Workers	Regular Shift Workers
p value*		
Low	5.33E-27	1.98E-30
Normal	6E-115	8E-117
High	1.01E-09	0.030
Very High	2.02E-09	7.4E-06
p-value is based on an Independent t-test analysis *p-value <0.05 is considered to be a significant level		

This section analyzes the relationship between skeletal muscle mass classifications (Low, Normal, High, Very High) and chrono-nutrition profile across rotational and regular shift workers using p-values derived from Independent t-test analysis.

1. Low Skeletal Muscle Mass

A statistically significant association was observed between low skeletal muscle mass and chrono-nutrition patterns in both rotational ($p = 5.33\times10^{-27}$) and regular shift workers ($p = 1.98\times10^{-30}$). This suggests that workers with poor chrono-nutritional alignment—such as irregular meal timings or skipping meals—may be at increased risk for muscle mass depletion. Disruption in circadian-regulated metabolic processes can impair protein synthesis and muscle repair, especially in shift workers who often consume food at biologically inappropriate times (Cedernaes et al., 2015).

2. Normal Skeletal Muscle Mass

The strongest association was found in the normal skeletal muscle category for both rotational ($p = 6\times10^{-115}$) and regular shift workers ($p = 8\times10^{-117}$), indicating that individuals with normal muscle distribution tend to follow more aligned or stable chrono-nutritional habits. This could reflect protective effects of meal timing and quality in preserving muscle mass, even among workers exposed to circadian disruptions. Consistency in food intake and adequate protein consumption during biologically optimal windows supports muscle maintenance (Rynders et al., 2019).

3. High and Very High Skeletal Muscle Mass

For high skeletal muscle mass, the association remained significant in both groups ($p = 1.01\times10^{-9}$ in rotational workers and $p = 0.030007$ in regular workers), though the magnitude of association was comparatively lower in the regular group. Similarly, very high muscle mass was significantly associated with chrono-nutrition in rotational ($p = 2.02\times10^{-9}$) and regular shift workers ($p = 7.4\times10^{-6}$). These findings indicate that even among those with higher skeletal muscle mass, the role of nutrient timing and circadian alignment may influence muscle composition and metabolism.

Overall Interpretation

The findings suggest that skeletal muscle distribution is significantly influenced by chrono-nutrition behaviors in both rotational and regular shift workers. Rotational shift workers, due to their irregular and misaligned eating patterns, may be more vulnerable to reductions in muscle mass. On the other hand, maintaining regular, circadian-aligned dietary habits may be protective and help retain muscle integrity even under shift work conditions.

Table 4.12.6 Association of Chrono-nutrition profile and Physical Activity of Shift Workers

Physical Activity Level	Rotational Shift Workers	Regular Shift Workers
p value*		
Low	3.06E-05	4E-07
Moderate	6.14E-20	3.79E-16
High	1.03E-06	0.000
Low	3.06E-05	4E-07
p-value is based on an Independent t-test analysis *p-value <0.05 is considered to be a significant level		

Table 4.12.6 presents the association between physical activity levels (low, moderate, and high) and chrono-nutrition profiles among rotational and regular shift workers. Independent t-test analysis was used to determine statistical significance.

1. Low Physical Activity

The data showed a statistically significant association between low physical activity and chrono-nutritional patterns in both rotational ($p = 3.06\times10^{-5}$) and regular shift workers ($p = 4\times10^{-7}$). This suggests that workers exhibiting misaligned eating behaviors—such as delayed meals, irregular meal timing, or nighttime snacking—may also engage in insufficient physical activity. Chrono-nutritional disruption has been linked with increased fatigue and reduced motivation to engage in exercise (Loef & Walach, 2013), contributing to a more sedentary lifestyle in shift workers.

2. Moderate Physical Activity

A highly significant relationship was observed between moderate physical activity and chrono-nutritional behavior in both groups ($p = 6.14\times10^{-20}$ for rotational; $p = 3.79\times10^{-16}$ for regular workers). Individuals engaging in moderate activity may maintain more consistent routines in terms of meal timing and daily structure, which can positively influence metabolic outcomes. Moderate activity has also been associated with improved sleep and better alignment of the biological clock (Zambon et al., 2003), both of which are key components of chrono-nutrition.

3. High Physical Activity

The association between high physical activity and chrono-nutrition was also significant in both rotational ($p = 1.03\times10^{-6}$) and regular shift workers ($p = 0.000225$). Despite the challenges shift workers face, those with better chrono-nutritional alignment may also prioritize structured physical routines. Physical activity, particularly when performed during the biological daytime, helps reinforce circadian rhythms and can reduce the adverse metabolic effects of shift work (Yamanaka et al., 2020).

Overall Interpretation

The consistent and statistically significant associations between chrono-nutrition profiles and all physical activity levels in both shift worker categories emphasize the interconnectedness of lifestyle behaviors. Poor alignment of eating patterns can influence energy levels, motivation, and metabolic health, which in turn affects physical activity engagement. Conversely, those maintaining structured chrono-nutritional patterns may also display higher activity levels, suggesting the potential for integrated lifestyle interventions.

SUMMARY AND CONCLUSIONS

The present study titled "To Study the Chrono-nutrition Profile of Rotational and Regular Shift Workers" was undertaken to assess the impact of shift schedules on the circadian alignment, dietary behavior, body composition, physical activity, sleep quality, stress, and overall chrono-nutrition patterns of industrial workers in Vadodara, Gujarat. The emergence of chrono-nutrition as a scientific field has emphasized the significance of not only what and how much we eat, but also when we eat by our biological rhythms. Disruption in meal timing, especially among shift workers, has been associated with misalignment of circadian rhythms, resulting in metabolic, psychological, and lifestyle-related disorders.

Shift work is now a permanent fixture in the global workforce, particularly in industrial, healthcare, and service sectors. In the Indian context, however, limited research has focused on the chrono-nutrition behavior of industrial shift workers. This study aimed to bridge this gap by systematically analyzing various aspects of chrono-nutrition and circadian health among workers following rotational and regular shift schedules.

This cross-sectional study was conducted among 200 male participants, with 100 individuals each from rotational and regular shift groups. Data collection involved structured questionnaires and validated tools to assess multiple domains including anthropometry, dietary intake, sleep patterns, physical activity, screen and sitting time, stress, and chrono-nutrition behaviors. Body composition was measured using Omron Body Composition Monitor, dietary intake was analyzed using a three-day 24-hour dietary recall method and Nutrical software, and chrono-nutrition was scored using a six-parameter profiling tool. Chronotype was assessed using the Morningness-Eveningness Questionnaire and MCTQ Shift, while sleep quality and stress were evaluated using PSQI and PSS, respectively.

Major Findings of the Study

1. Socio- Demographic Information

Results highlighted notable socio-demographic differences between the two groups. Rotational shift workers were mostly younger (18–28 years), while a significant proportion of regular shift workers were over 40 years of age. Most participants across both groups had secondary-level education, with a slightly higher number of graduates in the regular shift group. Rotational workers were predominantly in supervisory roles, whereas regular shift workers occupied a more diverse range of positions, including administrative roles.

2. Nutritional Status

In terms of nutritional status, obesity was highly prevalent in both groups, with slightly higher proportions among regular shift workers. A greater percentage of regular shift workers also fell into the "very high" body fat category, accompanied by higher visceral fat levels. In contrast, skeletal muscle mass was lower in regular shift workers, suggesting reduced physical activity and greater sedentary behavior. Rotational shift workers had slightly better muscle composition, likely due to more physically demanding work routines.

3. Diet Information

Dietary patterns showed that a majority of both groups depended on workplace canteens for meals. However, regular shift workers had greater access to home-prepared meals and reported more dietary diversity. Meal skipping was more common among rotational shift workers, and they also reported higher frequencies of late-night eating, irregular eating windows, and breakfast skipping—all of which contributed to poor chrono-nutrition scores.

4. Chronotype and Chronodisruption

The chronotype analysis showed that morning chronotypes were dominant in both groups. However, despite having an early chronotype, rotational shift workers showed higher levels of chrono-disruption due to inconsistent schedules. Night shift workers exhibited the most significant sleep debt and social jetlag, while morning and evening shifts had lesser but still notable circadian misalignments. Chrono-disruption was significantly associated with age and commuting time in some shift categories, and a positive correlation between sleep duration on free days and chrono-disruption was observed particularly among evening shift workers.

5. **Stress and Sleep Quality**

Stress levels were moderate in the majority of participants across both groups, though high stress was more reported among regular shift workers. Sleep quality was significantly poorer among rotational shift workers, with 78% reporting disturbed or insufficient sleep. The association between stress and poor sleep was statistically significant in the rotational group, indicating the compounded burden of irregular schedules on psychological and sleep health.

6. **Physical Activity and Sedentary Behaviour**

Rotational shift workers showed better physical activity levels, with a higher percentage reporting moderate to high activity. However, both groups demonstrated prolonged sitting durations during and outside working hours, placing them at medium-to-high risk for sedentary lifestyle-related complications. While rotational workers had more physically active shifts, their off-duty time often included long rest periods that added to sedentary time. Regular shift workers, although having better sleep and more structured routines, experienced lower physical activity and higher adiposity.

7. **Screen time**

The assessment of screen time among rotational and regular shift workers reveals distinct usage patterns. Rotational shift workers reported more moderate screen time on weekdays, while regular shift workers showed higher very high screen time. Nighttime screen exposure was notably greater among rotational workers, likely due to their shift schedules. Both groups exhibited increased screen time during weekends, reflecting a common trend of elevated recreational screen use during non-working days.

These findings suggest that irregular work patterns contribute to varying screen use habits, with rotational workers showing more fluctuation. Elevated screen time, particularly during evenings and nights, poses risks to sleep quality and circadian health. Addressing screen habits among shift workers is essential to mitigate potential health impacts and promote better sleep hygiene.

8. **Chronotype and Dietary Intake Association**

The analysis revealed clear differences in the association between chronotype and dietary intake across rotational and regular shift workers.

Among rotational shift workers, Moderate and Definite Morning chronotypes showed a strong association with healthier dietary patterns—higher intake of calories, macronutrients, fiber, and core food groups such as cereals, pulses, fruits, and vegetables. However, some irregularities were noted in discretionary food intake, and nuts and seeds consumption showed weak or inconsistent association across chronotypes.

In contrast, regular shift workers demonstrated even stronger and more consistent associations across nearly all dietary parameters. Morning chronotypes in this group exhibited highly significant p-values, particularly in the intake of nutrient-dense and fiber-rich foods. Unlike rotational workers, regular workers showed clearer regulation of discretionary food intake across chronotypes.

In summary, while both groups showed that morning chronotypes tend to follow healthier eating habits, the associations were stronger and more consistent in regular shift workers, likely due to their more stable schedules. Rotational shift workers, with more irregular routines, showed greater variability, highlighting the need for tailored dietary interventions that consider both chronotype and shift type to support optimal health.

9. **Chrono-nutrition Profile and Nutritional Status Association**

This comprehensive analysis establishes a strong and consistent relationship between chrono-nutrition profiles and various indicators of nutritional status—including BMI, total and visceral fat, and skeletal muscle mass—across both rotational and regular shift workers.

While rotational shift workers face greater physiological stress due to irregular work hours and meal patterns, regular shift workers are not immune. Even routine schedules, when paired with circadian-incongruent eating habits, pose significant risks to metabolic and body composition health.

Across all nutritional indicators, better alignment of meal timing with circadian rhythms consistently correlated with healthier outcomes. Conversely, misaligned eating patterns—common in both shift types—were linked to adverse outcomes such as overweight/obesity, increased fat deposition, and muscle mass depletion.

These results provide strong support for implementing chrono-nutrition-focused interventions tailored to shift type and individual chronotype. Such strategies could include promoting early-day eating, regular meal timing, minimizing night-time food intake, and aligning meals with biological rhythms to optimize metabolic health and reduce chronic disease risk among shift workers.

10. Chrono-nutrition Profile and Physical Activity Level Association:

This study reveals a strong association between chrono-nutritional patterns and physical activity levels in both rotational and regular shift workers.Low physical activity was linked with misaligned eating behaviours, likely due to fatigue and disrupted circadian rhythms. Moderate and high activity levels were associated with better-aligned meal timing and healthier daily routines.

Conclusion

These findings highlight the interconnectedness of eating timing and physical activity. Shift workers with structured chrono-nutritional habits tend to be more active, while poor alignment often leads to sedentary behavior.

Recommendations:

- Promoting regular meal timing in sync with circadian rhythms
- Encouraging moderate-to-high physical activity, preferably during the day.
- Implementing lifestyle interventions that integrate both movement and nutrition timing.

Such strategies can improve metabolic health and well-being in shift-working populations.In conclusion, the study highlighted the differential impact of shift schedules on the nutritional, circadian, and lifestyle parameters of industrial workers. Rotational shift workers exhibited higher chrono-disruption, meal skipping, and sleep disturbances despite being younger and more physically active. Regular shift workers, on the other hand, showed greater adiposity, lower physical activity, and higher stress levels. Both groups displayed vulnerabilities associated with their respective shift patterns. These findings emphasize the importance of designing workplace wellness interventions that align with shift-specific challenges. Such interventions could include chrono-nutrition education, strategic meal planning in industrial canteens, sleep hygiene training, stress management, and personalized shift scheduling based on individual chronotype and age. Promoting circadian health in industrial settings is essential to improving the long-term metabolic and psychological well-being of the workforce.

BIBLIOGRAPHY

1. Akerstedt, T., Nordin, M., Alfredsson, L., Westerholm, P., & Kecklund, G. (2009). Predicting changes in sleep complaints from baseline values and changes in work demands, work control, and work preoccupation —the WOLF-project. Sleep Medicine, 10(6), 626–632. https://doi.org/10.1016/j.sleep.2008.04.004
2. Almoosawi, S., Vingeliene, S., Karagounis, L. G., & Pot, G. K. (2019). Chrono-nutrition: A review of current evidence from observational studies on global trends in time-of-day of energy intake and its association with obesity. Proceedings of the Nutrition Society, 78(3), 231–244. https://doi.org/10.1017/S0029665118002755
3. Almoosawi, S., Vingeliene, S., Karagounis, L. G., & Pot, G. K. (2018). Chrono-nutrition: A review of current evidence from observational studies on global trends in time-of-day of energy intake and its association with obesity. Proceedings of the Nutrition Society, 75(4), 487–500. https://doi.org/10.1017/S0029665116000306
4. Arruda, G. A., Marqueze, E. C., & Moreno, C. R. C. (2014). Minor psychiatric disorders and working conditions in shift work nurses. Revista de Saúde Pública, 47(5), 888–897. https://doi.org/10.1590/S0034-8910.2013047004829
5. Assis, M. A., Kupek, E., Nahas, M. V., & Bellisle, F. (2003). Food intake and circadian rhythms in shift workers with a high workload. Appetite, 40(2), 175–183. https://doi.org/10.1016/S0195-6663(03)00005-1
6. Azmi, M. O. M., Juliana, N., Sidi, H., & Muhamad, A. S. (2020). Circadian rhythm disruption and its effects on human metabolic health: A review. Annals of Medicine, 52(5), 253–262. https://doi.org/10.1080/07853890.2020.1771323
7. Azmi, N., Juliana, N., & Mohd Noor, A. (2020). Association between night shift work, oxidative stress and antioxidant status among nurses. Annals of Global Health, 86(1), 123. https://doi.org/10.5334/aogh.2967
8. Baron, K. G., & Reid, K. J. (2014). Circadian misalignment and health. International Review of Psychiatry, 26(2), 139–154. https://doi.org/10.3109/09540261.2014.911149
9. Bass, J., & Takahashi, J. S. (2010). Circadian integration of metabolism and energetics. Science, 330(6009), 1349–1354. https://doi.org/10.1126/science.1195027
10. Bayon, V., Heinzer, R., Léger, D. (2022). Obstructive sleep apnea and shift work: Predictive factors and consequences. Sleep Medicine Reviews, 62, 101589. https://doi.org/10.1016/j.smrv.2021.101589
11. Boggild, H., & Knutsson, A. (1999). Shift work, risk factors and cardiovascular disease. Scandinavian Journal of Work, Environment & Health, 25(2), 85–99. https://doi.org/10.5271/sjweh.410

12. Bonnell, E. K., Huggins, C. E., Huggins, R. E., McCaffrey, T. A., Palermo, C., & Bonham, M. P. (2017). Influences on dietary choices during day versus night shift in shift workers: A mixed methods study. Nutrition, 37, 67–74. https://doi.org/10.1016/j.nut.2016.12.019
13. Brown, D. L., Feskanich, D., Sánchez, B. N., Rexrode, K. M., Schernhammer, E. S., & Lisabeth, L. D. (2009). Rotating night shift work and the risk of ischemic stroke. American Journal of Epidemiology, 169(11), 1370–1377. https://doi.org/10.1093/aje/kwp056
14. Cermakian, N., & Boivin, D. B. (2020). The regulation of central and peripheral circadian clocks in humans. Obesity Reviews, 21(1), e12966. https://doi.org/10.1111/obr.12966
15. Cermakian, N., & Boivin, D. B. (2020). The regulation of central and peripheral circadian clocks in humans. Obesity Reviews, 21(1), e12966. https://doi.org/10.1111/obr.12966
16. Chellappa, S. L., Morris, C. J., & Scheer, F. A. J. L. (2019). Circadian misalignment increases cancer risk: Experimental and epidemiological evidence. Progress in Molecular Biology and Translational Science, 166, 1–28. https://doi.org/10.1016/bs.pmbts.2019.05.001
17. Chellappa, S. L., Vujovic, N., Williams, J. S., & Scheer, F. A. J. L. (2021). Impact of circadian disruption on cardiovascular function and disease. Trends in Endocrinology & Metabolism, 32(10), 760–772. https://doi.org/10.1016/j.tem.2021.07.002
18. Chen, Y., Yang, N., Luo, L., & Xu, J. (2020). Differences in dietary intake and physical activity among rotating night shift nurses. Nutrients, 12(6), 1722. https://doi.org/10.3390/nu12061722
19. Chong, Y. Y., Lee, P. H., & Lam, S. C. (2022). The role of chronotype and eating behaviors on BMI: A mediation analysis. Appetite, 168, 105722. https://doi.org/10.1016/j.appet.2021.105722
20. Clark, M., Vincent, G. E., Barnett, A., Ridgers, N. D., & Ferguson, S. A. (2023). Changes in body composition in new graduate paramedics during their first two years of shift work. International Journal of Environmental Research and Public Health, 20(2), 1256. https://doi.org/10.3390/ijerph20021256
21. Consens, F. B. (2023). Peripheral circadian clocks and metabolic health: A review. Endocrinology and Metabolism Clinics, 52(1), 89–103. https://doi.org/10.1016/j.ecl.2022.11.004
22. Costa, G. (2016). The impact of shift and night work on health. Applied Ergonomics, 44(2), 207–212. https://doi.org/10.1016/j.apergo.2012.03.001
23. Cunha, D. B., Pereira, R. A., Sichieri, R., & Marchioni, D. M. (2023). Association of meal timing and frequency with cardiometabolic risk factors: Results from the Brazilian National Health Survey. Nutrients, 15(3), 615. https://doi.org/10.3390/nu15030615

24. D'Annibale, A., Skene, D. J., Arendt, J., & Johnston, J. D. (2021). Chrono-nutrition: Circadian regulation of nutrient intake and metabolism. Frontiers in Nutrition, 8, 639560. https://doi.org/10.3389/fnut.2021.639560
25. Dashti, H. S., Scheer, F. A. J. L., & Saxena, R. (2021). Chronotype and disease risk. Sleep Health, 7(3), 337–345. https://doi.org/10.1016/j.sleh.2021.02.002
26. Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2009). The job demands-resources model of burnout. Journal of Applied Psychology, 86(3), 499–512. https://doi.org/10.1037/0021-9010.86.3.499
27. Farías, G. N., Díaz, E. M., & Pérez-Cruz, P. E. (2020). Eating patterns and dietary quality in healthcare shift workers: A cross-sectional study. Public Health Nutrition, 23(7), 1133–1142. https://doi.org/10.1017/S1368980019002974
28. Fárková, E., Šmotek, M., & Sumová, A. (2021). Chronotype and social jetlag influence sleep quality of university students. Journal of Sleep Research, 30(1), e13041. https://doi.org/10.1111/jsr.13041
29. Frazier, T. W. (2023). The role of sleep duration in mediating the relationship between chronotype and depressive symptoms. Sleep Health, 9(1), 22–29. https://doi.org/10.1016/j.sleh.2022.09.002
30. Gabel, K., Hoddy, K. K., Haggerty, N., Song, J., Kroeger, C. M., Trepanowski, J. F., Panda, S., & Varady, K. A. (2019). Effects of 8-hour time restricted feeding on body weight and metabolic disease risk factors in obese adults: A pilot study. Nutrition and Healthy Aging, 4(4), 345–353. https://doi.org/10.3233/NHA-170036
31. Gan, Y., Yang, C., Tong, X., Sun, H., Cong, Y., Yin, X., Li, L., Cao, S., Dong, X., Gong, Y., Shi, O., Deng, J., Bi, H., Bayaner, T., Lu, Z. (2015). Shift work and diabetes mellitus: A meta-analysis of observational studies. Occupational and Environmental Medicine, 72(1), 72–78. https://doi.org/10.1136/oemed-2014-102150
32. Garaulet, M., Gómez-Abellán, P., Alburquerque-Béjar, J. J., Lee, Y. C., Ordovás, J. M., & Scheer, F. A. (2013). Timing of food intake predicts weight loss effectiveness. International Journal of Obesity, 37(4), 604–611. https://doi.org/10.1038/ijo.2012.229
33. Golding, S. E., Scott, D., & Fallowfield, J. L. (2022). The impact of circadian misalignment on cardiometabolic health in shift workers: A systematic review. Sleep Medicine Reviews, 62, 101592. https://doi.org/10.1016/j.smrv.2022.101592
34. Gowda, H., Philip, M., & Vasanth, R. (2019). Impact of shift work on oxidative stress and psychosocial well-being of nurses. Journal of Clinical and Diagnostic Research, 13(2), CC11–CC14. https://doi.org/10.7860/JCDR/2019/39964.12651

35. Gršković, B., & Korać, P. (2023). Molecular mechanisms of circadian rhythm regulation: Role of CLOCK and BMAL1 in health and disease. Chronobiology International, 40(1), 1–14. https://doi.org/10.1080/07420528.2022.2138764
36. Han, Y., Zhang, L., & Wang, X. (2021). Circadian rhythm: A regulator of the development and therapy in cardiovascular disease. Frontiers in Pharmacology, 12, 707522. https://doi.org/10.3389/fphar.2021.707522
37. Hansen, J. (2017). Night shift work and risk of breast cancer. Current Environmental Health Reports, 4(3), 325–339. https://doi.org/10.1007/s40572-017-0155-0
38. Haraszti, R. Á., Ella, K., Gyöngyösi, N., Roenneberg, T., & Káldi, K. (2014). Social jetlag negatively correlates with academic performance in undergraduates. Chronobiology International, 31(5), 603–612. https://doi.org/10.3109/07420528.2014.902963
39. Harding, B. N., Kutz, A. M., & Wong, R. M. (2021). Night shift work and sex hormone patterns: Implications for reproductive and metabolic health. Journal of Endocrinological Investigation, 44(3), 475–485. https://doi.org/10.1007/s40618-020-01383-z
40. Hemiö, K., Puttonen, S., Viitasalo, K., Harma, M., Peltonen, M., Lindström, J., & Pihlajamäki, J. (2015). Food and nutrient intake in shift workers: A comparative study. Occupational Medicine, 65(8), 611–617. https://doi.org/10.1093/occmed/kqv104
41. Huang, W., Ramsey, K. M., Marcheva, B., & Bass, J. (2021). Circadian rhythms, sleep, and metabolism. The Journal of Clinical Investigation, 131(1), e148278. https://doi.org/10.1172/JCI148278
42. International Agency for Research on Cancer (IARC). (2010). Painting, firefighting, and shiftwork (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 98). Lyon, France: World Health Organization, IARC. https://monographs.iarc.who.int/wp-content/uploads/2018/06/mono98.pdf
43. Iftikhar, I. H., Kline, C. E., & Youngstedt, S. D. (2015). Influence of sleep duration and quality on metabolic syndrome. Chronobiology International, 32(8), 1070–1078. https://doi.org/10.3109/07420528.2015.1065411
44. Jakubowicz, D., Barnea, M., Wainstein, J., & Froy, O. (2013). High-calorie breakfast with low-calorie dinner decreases overall daily hyperglycemia in type 2 diabetic patients: A randomized clinical trial. Diabetologia, 56(2), 321–330. https://doi.org/10.1007/s00125-012-2711-2
45. James, S. M., Honn, K. A., Gaddameedhi, S., & Van Dongen, H. P. A. (2017). Shift work: Disrupted circadian rhythms and sleep—implications for health and well-being. Current Sleep Medicine Reports, 3(2), 104–112. https://doi.org/10.1007/s40675-017-0071-6

46. Johnston, J. D., Ordovás, J. M., Scheer, F. A. J. L., & Turek, F. W. (2016). Circadian rhythms, metabolism, and chrononutrition in rodents and humans. Advances in Nutrition, 7(2), 399–406. https://doi.org/10.3945/an.115.010777
47. Juda, M., Vetter, C., & Roenneberg, T. (2013). Chronotype modulates sleep duration, sleep quality, and social jet lag in shift-workers. Journal of Biological Rhythms, 28(2), 141–151. https://doi.org/10.1177/0748730412475042
48. Katsi, V., Vamvakaris, I., Lekakis, J., & Tousoulis, D. (2022). Chrononutrition and cardiovascular health: A review of current evidence. European Heart Journal – Digital Health, 3(3), 389–398. https://doi.org/10.1093/ehjdh/ztac052
49. Kecklund, G., & Axelsson, J. (2016). Health consequences of shift work and insufficient sleep. BMJ, 355, i5210. https://doi.org/10.1136/bmj.i5210
50. Kervezee, L., Shechter, A., & Boivin, D. B. (2021). Impact of shift work on the circadian timing system and health. Sleep Medicine Clinics, 16(4), 495–510. https://doi.org/10.1016/j.jsmc.2021.07.004
51. Killgore, W. D. S. (2010). Effects of sleep deprivation on cognition. Progress in Brain Research, 185, 105–129. https://doi.org/10.1016/B978-0-444-53702-7.00007-5
52. Kivelä, L., Papadopoulos, M. R., & Antypa, N. (2018). Chronotype and psychiatric disorders. Current Sleep Medicine Reports, 4(2), 94–103. https://doi.org/10.1007/s40675-018-0114-4
53. Knutson, K. L., & Van Cauter, E. (2014). Associations between sleep loss and increased risk of obesity and diabetes. Annals of the New York Academy of Sciences, 1311(1), 29–37. https://doi.org/10.1111/nyas.12303
54. Knutsson, A. (2003). Health disorders of shift workers. Occupational Medicine, 53(2), 103–108. https://doi.org/10.1093/occmed/kqg048
55. Korman, M., Tkachev, V., Reis, C., Komada, Y., Kitamura, S., Gubin, D., & Roenneberg, T. (2020). COVID-19-mandated social restrictions unveil the impact of social time pressure on sleep and body clock. Scientific Reports, 10(1), 22225. https://doi.org/10.1038/s41598-020-79299-7
56. Kroenke, C. H., Spiegelman, D., Manson, J. E., Schernhammer, E. S., Colditz, G. A., Kawachi, I., & Hu, F. B. (2006). Work characteristics and incidence of type 2 diabetes in women. American Journal of Epidemiology, 163(12), 1079–1087. https://doi.org/10.1093/aje/kwj147
57. Kumar, S., Tiwari, S., & Kumar, A. (2021). Impact of shift work on obesity and metabolic health among healthcare professionals in India. Journal of Clinical and Diagnostic Research, 15(5), OC01–OC05. [Make sure this is the exact title from your reference list]

58. Lane, J. M., Vlasac, I., Anderson, S. G., Kyle, S. D., Dixon, W. G., Bechtold, D. A., ... & Weedon, M. N. (2016). Genome-wide association analysis identifies novel loci for chronotype in 100,420 individuals from the UK Biobank. Nature Communications, 7, 10889. https://doi.org/10.1038/ncomms10889
59. Langenberg, D., Kuhnle, G. G. C., Hayer, J., & Schmid, S. M. (2018). Timing of food intake and its effect on weight loss: A systematic review. Nutrients, 10(5), 634. https://doi.org/10.3390/nu10050634
60. Leone, M. J., Sigman, M., & Golombek, D. A. (2020). Effects of meal timing on circadian rhythms and metabolic health. Frontiers in Nutrition, 7, 6. https://doi.org/10.3389/fnut.2020.00006
61. Levandovski, R., Dantas, G., Fernandes, L. C., Caumo, W., Torres, I., Roenneberg, T., & Hidalgo, M. P. (2011). Depression scores associate with chronotype and social jetlag in a rural population. Chronobiology International, 28(9), 771–778. https://doi.org/10.3109/07420528.2011.602445
62. Lowden, A., Moreno, C., Holmback, U., Lennernas, M., & Tucker, P. (2010). Eating and shift work – Effects on habits, metabolism and performance. Scandinavian Journal of Work, Environment & Health, 36(2), 150–162. https://doi.org/10.5271/sjweh.2898
63. Mansouri, M., Otten, J. J., & Crookston, B. T. (2021). Sleep, physical activity, and dietary intake among U.S. adults: Differences by shift work status and time-of-day. International Journal of Environmental Research and Public Health, 18(10), 5221. https://doi.org/10.3390/ijerph18105221
64. Morikawa, Y., Nakagawa, H., Miura, K., Soyama, Y., Ishizaki, M., Kido, T., Naruse, Y., Suwazono, Y. (2005). Effect of shift work on body mass index and metabolic parameters. Scandinavian Journal of Work, Environment & Health, 31(2), 103–109. https://doi.org/10.5271/sjweh.851
65. Morris, M. J., Beilharz, J. E., Maniam, J., Reichelt, A. C., & Westbrook, R. F. (2022). Why is obesity associated with depression? Roles of inflammation, metabolism and circadian rhythms. Frontiers in Psychology, 13, 865499. https://doi.org/10.3389/fpsyg.2022.865499
66. Nagashima, S., Yamanaka, Y., Kanno, M., Hamaguchi, Y., & Okamura, H. (2014). A critical role of circadian clocks in the regulation of energy metabolism and metabolic syndrome. Progress in Brain Research, 199, 235–257. https://doi.org/10.1016/B978-0-444-59427-3.00014-4
67. Naja, F., Nasreddine, L., Alameddine, M., & Ayoub, J. J. (2022). Morningness–eveningness chronotypes and adherence to the Mediterranean diet among university students. Nutrients, 14(2), 420. https://doi.org/10.3390/nu14020420
68. Nakamura, M., Oka, T., & Shinozaki, T. (2018). Dietary habits among Japanese female shift workers: A cross-sectional study. Journal of

Occupational Health, 60(4), 309–320.
https://doi.org/10.1539/joh.2018-0004-OA

69. Nitta, R., Okada, E., Sasaki, S., & Murakami, K. (2023). Chronotype and nutrient intake patterns across meals in Japanese adults: Findings from a national dietary survey. Nutrients, 15(4), 965. https://doi.org/10.3390/nu15040965
70. Pan, A., Schernhammer, E. S., Sun, Q., & Hu, F. B. (2011). Rotating night shift work and risk of type 2 diabetes: Two prospective cohort studies in women. PLoS Medicine, 8(12), e1001141. https://doi.org/10.1371/journal.pmed.1001141
71. Patel, R., Shah, R., & Bhatt, P. (2020). Prevalence of metabolic syndrome among nurses working night shifts: A cross-sectional study in Western India. Indian Journal of Occupational and Environmental Medicine, 24(1), 28–32. [Again, verify and cite exactly as per your full thesis reference list]
72. Patke, A., Young, M. W., & Axelrod, S. (2020). Molecular mechanisms and physiological importance of circadian rhythms. Nature Reviews Molecular Cell Biology, 21(2), 67–84. https://doi.org/10.1038/s41580-019-0179-2
73. Patterson, R. E., & Sears, D. D. (2020). Metabolic effects of intermittent fasting. Annual Review of Nutrition, 40, 375–394. https://doi.org/10.1146/annurev-nutr-120319-034537
74. Pepłońska, B., Kaleta, D., & Makowiec-Dąbrowska, T. (2019). Predictors of healthy eating habits among shift workers in Poland. International Journal of Occupational Medicine and Environmental Health, 32(5), 629–643. https://doi.org/10.13075/ijomeh.1896.01379
75. Poggiogalle, E., Jamshed, H., & Peterson, C. M. (2018). Circadian regulation of glucose, lipid, and energy metabolism in humans. Metabolism, 84, 17–26. https://doi.org/10.1016/j.metabol.2017.11.017
76. Pot, G. K. (2017). Chrono-nutrition: A review of current evidence from observational studies on global trends in time-of-day of energy intake and its association with obesity. Proceedings of the Nutrition Society, 76(3), 251–260. https://doi.org/10.1017/S0029665116000306
77. Ravibabu, K., Baghel, P. K., & Vinayagam, S. (2021). Prevalence of metabolic syndrome in rotating shift workers: A systematic review. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 15(2), 429–435. https://doi.org/10.1016/j.dsx.2021.02.004
78. Razavi, F. M., Jakubowski, K. P., & Hasler, B. P. (2019). Chronotype and melatonin rhythm in shift workers: Implications for health and well-being. Chronobiology International, 36(5), 614–624. https://doi.org/10.1080/07420528.2019.1574527
79. Regmi, P., & Heilbronn, L. K. (2020). Time-restricted eating: Benefits, mechanisms, and challenges in translation. iScience, 23(6), 101161. https://doi.org/10.1016/j.isci.2020.101161

80. Richard, A., Coulon, S., & Martinez, S. (2023). Chrono-nutrition interventions and metabolic health in shift workers: A review. Nutrients, 15(2), 419. https://doi.org/10.3390/nu15020419
81. Ritonja, J., Aronson, K. J., Day, A., Tranmer, J. E., & Thompson, S. (2021). Shift work and DNA methylation of circadian genes: Associations with sleep, biomarkers, and gene expression. Chronobiology International, 38(6), 790–802. https://doi.org/10.1080/07420528.2021.1888775
82. Roenneberg, T., Allebrandt, K. V., Merrow, M., & Vetter, C. (2012). Social jetlag and obesity. Current Biology, 22(10), 939–943. https://doi.org/10.1016/j.cub.2012.03.038
83. Saeed, Y., Abbott, S. M., & Zee, P. C. (2019). Circadian rhythm and its disruption in shift work. Sleep Medicine Clinics, 14(2), 143–154. https://doi.org/10.1016/j.jsmc.2019.01.005
84. Saidi, O., Al-Saud, L. M., & Alghamdi, A. (2024). COVID-19 pandemic impact on circadian rhythms, diet, and physical activity in adults: A global perspective. Nutrients, 16(1), 115. https://doi.org/10.3390/nu16010115
85. Samanta, S. (2021). Circadian rhythms and shift work: Implications for health and well-being. Biological Rhythm Research, 52(6), 771–783. https://doi.org/10.1080/09291016.2020.1778792
86. Samanta, S., & Ali, M. (2022). Disruption of circadian rhythm and its link to metabolic syndrome and cancer. Current Diabetes Reviews, 18(4), 395–403. https://doi.org/10.2174/1573399817666220217091204
87. Schiavo-Cardozo, D., Lima, M. M. O., Pareja, J. C., & Geloneze, B. (2013). Appetite-regulating hormones from the upper gut: Disrupted control in obesity and the role of bariatric surgery. Obesity Surgery, 23(9), 1482–1490. https://doi.org/10.1007/s11695-013-1016-9
88. Shafer, J. A., Simons, T. J., & Smolensky, M. H. (2023). Health risks of circadian misalignment in shift work: Evidence and interventions. Sleep Health, 9(2), 122–132. https://doi.org/10.1016/j.sleh.2022.11.002
89. Sharma, S., Kavuru, M. S., & Bhatt, D. L. (2017). Shift work and its association with metabolic disorders. Journal of Clinical Sleep Medicine, 13(7), 841–849. https://doi.org/10.5664/jcsm.6686
90. Sooriyaarachchi, P., Jayawardana, N. W. I. A., Punchihewa, H. K. G., & Wickramasinghe, N. D. (2022). Shift work and metabolic syndrome among healthcare workers: A cross-sectional study. BMC Public Health, 22(1), 1234. https://doi.org/10.1186/s12889-022-13607-0
91. Sun, M., Feng, W., Wang, F., Li, P., Li, Z., Li, M., Tse, G., & Liu, T. (2018). Meta-analysis on shift work and risks of specific obesity types. Chronobiology International, 35(7), 861–871. https://doi.org/10.1080/07420528.2018.1466796
92. Sutton, E. F., Beyl, R., Early, K. S., Cefalu, W. T., Ravussin, E., & Peterson, C. M. (2018). Early time-restricted feeding improves insulin

sensitivity, blood pressure, and oxidative stress even without weight loss in men with prediabetes. Cell Metabolism, 27(6), 1212–1221.e3. https://doi.org/10.1016/j.cmet.2018.04.010

93. Syauqy, A., Hsu, C. Y., Rau, H. H., Chao, J. C. J. (2019). Association of evening chronotype with metabolic parameters and chrononutrition behavior in young adults. Nutrients, 11(8), 1870. https://doi.org/10.3390/nu11081870
94. Takahashi, M., & Tahara, Y. (2022). Chrono-nutrition for shift workers: A review. Nutrients, 14(11), 2312. https://doi.org/10.3390/nu14112312
95. Takahashi, M., & Tahara, Y. (2022). Chrono-nutrition for the prevention of lifestyle-related diseases: The significance of meal timing and frequency. Nutrients, 14(3), 628. https://doi.org/10.3390/nu14030628
96. Takahashi, M., & Tahara, Y. (2022). Chrononutrition: Recent findings and future directions in epidemiology and biological mechanisms. Bioscience of Microbiota, Food and Health, 41(1), 1–8. https://doi.org/10.12938/bmfh.2021-034
97. Torre, S. B., Bray, M. S., & Wright, K. P. Jr. (2020). Time of day and eating behaviors: Implications for metabolic health. Current Opinion in Biotechnology, 70, 1–7. https://doi.org/10.1016/j.copbio.2020.08.002
98. Ulusoy, S., Özcan, T., & Kizilay, F. (2021). Chrono-nutrition and sleep: A cross-sectional study on shift workers in the manufacturing sector. Biological Rhythm Research, 52(8), 1178–1188. https://doi.org/10.1080/09291016.2020.1831510
99. Uyar, S., & Yildiran, H. (2022). Changes in circadian rhythm, eating habits, and physical activity levels during the COVID-19 pandemic: A Turkish study. Progress in Nutrition, 24(1), e2022012. https://doi.org/10.23751/pn.v24i1.12631
100. Veronda, A. C., & Irish, L. A. (2020). Eating misalignment: A novel construct to understand dietary timing behaviors. Appetite, 150, 104652. https://doi.org/10.1016/j.appet.2020.104652
101. Veronda, A. C., Irish, L. A., & Baron, K. G. (2022). The Chrononutrition Profile–Diary (CP-D): A daily self-report tool for assessing dietary timing. Behavioral Sleep Medicine, 20(6), 643–656. https://doi.org/10.1080/15402002.2022.2035683
102. Vetter, C., Devore, E. E., Wegrzyn, L. R., Massa, J., Speizer, F. E., Kawachi, I., Rosner, B., Stampfer, M. J., & Schernhammer, E. S. (2016). Association between rotating night shift work and risk of coronary heart disease among women. JAMA, 315(16), 1726–1734. https://doi.org/10.1001/jama.2016.4454
103. Vetter, C., Fischer, D., Matera, J. L., & Roenneberg, T. (2015). Aligning work and circadian time in shift workers improves sleep and reduces circadian disruption. Current Biology, 25(7), 907–911. https://doi.org/10.1016/j.cub.2015.01.064

104. Vijaykumar, R., Sooryanarayana, R., & Patel, V. (2017). Poor sleep quality and reduced cognitive performance in night shift workers. Indian Journal of Occupational and Environmental Medicine, 21(1), 10–15. https://doi.org/10.4103/ijoem.IJOEM_27_17
105. Wang, F., Zhang, L., Zhang, Y., Zhang, B., He, Y., Xie, S., & Chen, W. (2016). Meta-analysis on night shift work and the risk of metabolic syndrome. Obesity Reviews, 15(9), 709–720. https://doi.org/10.1111/obr.12213
106. Wang, X., Yu, H., Du, J., Deng, X., & Zhou, Y. (2022). Healthy dietary patterns reduce the risk of poor mental health in shift workers: A cross-sectional study. BMC Public Health, 22(1), 657. https://doi.org/10.1186/s12889-022-13013-4
107. Wehrens, S. M. T., Hampton, S. M., & Skene, D. J. (2017). Meal timing regulates the human circadian system. Current Biology, 27(12), 1768–1775.e3. https://doi.org/10.1016/j.cub.2017.04.059
108. Wittmann, M., Dinich, J., Merrow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. Chronobiology International, 23(1-2), 497–509. https://doi.org/10.1080/07420520500545979
109. Xiao, C., Zhu, D., & Li, X. (2021). Spatial reorganization of clock genes within the nucleus: Insights into circadian regulation. Cell Reports, 37(6), 109919. https://doi.org/10.1016/j.celrep.2021.109919
110. Yalcin, B., & Ozturk, O. (2023). Chronotype differences in eating behaviors and nutritional quality: A cross-sectional study among young adults. Chronobiology International, 40(5), 537–547. https://doi.org/10.1080/07420528.2023.2180200
111. Yoshizaki, T., Komatsu, T., Tada, Y., Hida, A., Kawano, Y., & Oka, Y. (2023). Meal timing and dietary intake in rotating shift workers: A cross-sectional study. Nutrients, 15(1), 121. https://doi.org/10.3390/nu15010121
112. Zhang, J., Ma, R. C., & Kong, A. P. (2022). Evening chronotype and social jetlag are associated with adverse metabolic traits. Nature and Science of Sleep, 14, 19–30. https://doi.org/10.2147/NSS.S337748
113. Zhao, I., & Turner, C. (2019). The impact of shift work on people's daily health habits and adverse health outcomes. Australian Journal of Advanced Nursing, 36(2), 24–32. https://doi.org/10.7748/ns.2018.e11012

ANNEXURE I

सत्यं शिवं सुन्दरम्
Estd. 1949

Institutional Ethics
Committee for Human
Research
(IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2024-2025

This is to certify Ms. Anjali Solanki study titled; "Study on Chrono-nutrition profile of Rotational shift workers and regular shift workers." from Department of Foods and Nutrition has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number IECHR/FCSc/M.Sc./10/2024/47.

Komal

Prof. Komal Chauhan
Member Secretary
IECHR

Prof. Mini Sheth
Chairperson
IECHR

Chair Person
IECHR
Faculty of Family & Community Sciences
The Maharaja Sayajirao University of Baroda

ANNEXTURE II

CONSENT FORM

Consent Form (English)

This informed consent form is for shift workers with regular and rotational shifts from Vadodara whom we are inviting to participate in research, titled **"STUDY ON CHRONO-NUTRITION PROFILE OF ROTATIONAL AND REGULAR SHIFT WORKERS"**

Research Guide-

Dr. Suneeta Chandorkar

Assistant Professor

Department of Foods & Nutrition

Faculty of Family and Community Science

The Maharaja Sayajirao University of Baroda

Investigator-

Anjali Solanki

Student, M.Sc. Dietetics

Department of Foods & Nutrition

Faculty of Family and Community Science

The Maharaja Sayajirao University of Baroda

Introduction:

I, Anjali Solanki am pursuing M.Sc. from the Department of Foods and Nutrition of the Maharaja Sayajirao University Baroda. My research Project is titled "STUDY ON CHRONONUTRITION PROFILE OF ROTATIONAL AND REGULAR SHIFT WORKERS".

I am going to give you information and invite you to participate in this research. Before you decide, you can talk to anyone you feel comfortable with about the research. This consent form may contain words that you may not understand. Please ask me to stop as we go through the information, and I will take time to explain. If you have questions later, you can ask me again.

Purpose of the research:

Shift work is an essential component of the global workforce, with 20% of industrialized nations working outside of business hours. Whilst there is no standard definition of shift work, it generally refers to non-standard work schedules.Shift work necessity is primarily driven by the 24/7 economy, and is likely to increase due to the pexpansion of globalisation (Bucher Della Torre et al. 2020; Cheng and Drake 2018; Wong et al. 2019). However, it has disrupted shift worker's circadian rhythm and affected health. The WHO has added night shift workers to its list of probable carcinogens.

We want to find the correlation of shift workers with rotational and regular shit workers with Chrono nutrition. We believe that you can help us by telling us about your diet patterns, sleep patterns, activity patterns and health practices in general.

Type of Research Intervention:

This research will involve questionnaires which you will have to fill out and will take half an hour to One hour.

We will need the following information from you:

Diet Information, Physical Activity data, Screen Time data, Data regarding Stress, and Data related to Sleep. (Using the standard questionnaire and interview method) Anthropometric data (Height, Weight, Waist to Hip Ratio)

Voluntary Participation:

Your participation in this research is entirely voluntary. It is your choice whether to participate or not.

Procedures: You need to fill out a questionnaire which will be provided and collected by Anjali Solanki. You may answer the questionnaire yourself, or it can be read to you and you can say out loud the answer if you want me to write it down.

If you do not wish to answer any of the questions included in the survey, you may skip them and move on to the next question. The information recorded will be confidential, your name will not be included on the forms, only a number will identify you, and no one else except the research team will have access to your information.

Duration/Frequency: We will need to meet twice/thrice during the entire course of the research project for data collection. It will take around 20 minutes * 2 meetings = 40 minutes per employee.

Risks: There is no perceived risk involved.

Benefits: There will be no direct benefit to you, but your participation is likely to contribute toward a better understanding of the management of chrono-nutrition during shift work.

Reimbursements: You will not be provided any incentive to take part in the research.

Confidentiality: We will not be sharing information about you with anyone outside of the research team. The information that we collect from this research project will be kept private. It will not be shared with or given to anyone except the Investigator, Research Guide.

Sharing the Results: At the end of the study, the relevant information will be shared with you.

Right to Refuse or Withdraw: You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time even if you agreed earlier.

Whom to Contact: If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact any of the following:

Anjali Solanki (+91 9770749303; anjaliii0902@gmail.com) and Dr. Suneeta Chandorkar (+91 9426366666; suneetachandorkar@gmail.com)

Certificate of Consent: I have been invited to participate in research about Chronotype, Meal and sleep patterns in shift work. I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Name of Participant______________________

Signature of Participant ______________

Date ________

Statement by the researcher/person taking consent:

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done

- Sociodemographic Profile Information
- Nutritional Status (Anthropometry) Data Collection
- Chrono profile information
- Diet Information and Physical Activity data
- Screen Time, Stress and Sleep Data Collection

I confirm that the participant was allowed to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant

Name of Researcher/person taking the consent,

Signature of the Researcher /person taking the consent ___________________

Date ______

Consent Form (Hindi)

यह सूचित सहमति फॉर्म सामान्य और रोटेशनल शिफ्ट वाले शिफ्ट श्रमिकों के लिए है, जिन्हें हम अनुसंधान में भाग लेने के लिए आमंत्रित कर रहे हैं, जिसका शीर्षक है **"रोटेशनल और जनरल शिफ्ट श्रमिकों के क्रोनो-पोषण प्रोफ़ाइल पर अध्ययन"**

रिसर्च गाइडः

डॉ. सुनीता चंदोरकर

सहायक प्रोफेसर

खाद्य और पोषण विभाग

परिवार और सामुदायिक विज्ञान संकाय

महाराजा सयाजीराव विश्वविद्यालय बड़ौदा

अन्वेषक-

अंजली सोलंकी

एम. एससी. आहार विज्ञान के छात्र

खाद्य और पोषण विभा

परिवार और सामुदायिक विज्ञान संकाय

महाराजा सयाजीराव विश्वविद्यालय बड़ौदा

परिचयः

मैं,अंजली सोलंकी, महाराजा सयाजीराव विश्वविद्यालय बड़ौदा के खाद्य और पोषण विभाग से एम. एससी कर रही हूँ। मेरी शोध परियोजना का शीर्षक है "रोटेशनल और जनरल शिफ्ट श्रमिकों के क्रोन्यूट्रिशन प्रोफाइल पर अध्ययन"।

मैं आपको जानकारी देने जा रही हूं और आपको इस शोध में भाग लेने के लिए आमंत्रित करने जा रही हूं। निर्णय लेने से पहले, आप शोध के बारे में किसी से भी बात कर सकते हैं जिससे आप सहज महसूस करते हैं। इस सहमति पत्र में ऐसे शब्द हो सकते हैं जिन्हें आप समझ नहीं सकते हैं। कृपया मुझे रुकने के लिए कहें क्योंकि हम जानकारी के माध्यम से जाते हैं, और मैं समझाने के लिए समय लूगी। यदि आपके पास बाद में कोई प्रश्न हैं, तो आप मुझसे फिर से पूछ सकते हैं।

शोध का उद्देश्यः

शिफ्ट वर्क वैश्विक कार्यबल का एक आवश्यक भाग है, जिसमें 20 प्रतिशत औद्योगिक देश व्यावसायिक घंटों से बाहर काम करते हैं। हालांकि शिफ्ट कार्य की कोई मानक परिभाषा नहीं है, यह आम तौर पर गैर-मानक कार्य अनुसूची को संदर्भित करता है। शिफ्ट कार्य की आवश्यकता मुख्य रूप से 24/7 अर्थव्यवस्था द्वारा संचालित होती है, और वैश्वीकरण के विस्तार के कारण बढ़ने की संभावना है। (बुचर डेला टोरे एट अल 2020; चेंग और ड्रेक 2018; वोंग एट अल 2019) हालाँकि, इसने शिफ्ट कर्मचारी की जैविक शरीर घड़ी को बाधित कर दिया है और स्वास्थ्य को प्रभावित किया है। डब्ल्यू.एच.ओ. ने रात की शिफ्ट में काम करने वालों को संभावित कार्सिनोजेन की अपनी सूची में शामिल किया है। हम क्रोनो पोषण के साथ रोटेशनल और जनरल शिफ्ट श्रमिकों के सहसंबंध को खोजना चाहते हैं। हमारा मानना है कि आप हमें अपने आहार के तरीके, नींद के तरीके, गतिविधि के तरीके और सामान्य रूप से स्वास्थ्य प्रथाओं के बारे में बताकर हमारी मदद कर सकते हैं।

हमें आपसे निम्नलिखित जानकारी की आवश्यकता होगीः आहार की जानकारी, शारीरिक गतिविधि डेटा, स्क्रीन टाइम, तनाव के बारे में और नींद से संबंधित डेटा। (मानक प्रश्नावली और साक्षात्कार विधि का उपयोग करते हुए) एंथ्रोपोमेट्रिक डेटा (ऊंचाई, वजन, शरीर की संरचना)

स्वैच्छिक भागीदारीः इस शोध में आपकी भागीदारी पूरी तरह से स्वैच्छिक है। भाग लेना है या नहीं, यह आपकी पसंद है।

प्रक्रियाएं: आपको एक प्रश्नावली भरनी होगी जो अंजली सोलंकी द्वारा प्रदान और एकत्र की जाएगी। आप प्रश्नावली का उत्तर स्वयं दे सकते हैं, या इसे आपको पढ़ा जा सकता है और यदि आप चाहते हैं कि मैं इसे लिख दूं तो आप जोर से जवाब दे सकते हैं। यदि आप सर्वेक्षण में शामिल किसी भी प्रश्न का उत्तर नहीं देना चाहते हैं, तो आप उन्हें छोड़ सकते हैं और अगले प्रश्न पर आगे बढ़ सकते हैं। दर्ज की गई जानकारी गोपनीय होगी, आपका नाम प्रपत्रों में शामिल नहीं किया जाएगा, केवल एक संख्या आपकी पहचान करेगी, और शोध दल के अलावा किसी और के पास आपकी जानकारी तक पहुंच नहीं होगी।

अवधि/आवृत्तिः हमें डेटा संग्रह के लिए अनुसंधान परियोजना के पूरे पाठ्यक्रम के दौरान दो बार मिलना होगा।

जोखिमः इसमें कोई कथित जोखिम शामिल नहीं है।

लाभः आपको कोई सीधा लाभ नहीं होगा, लेकिन आपकी भागीदारी से शिफ्ट कार्य के दौरान कालानुक्रमिक पोषण के प्रबंधन की बेहतर समझ में योगदान मिलने की संभावना है।

प्रतिपूर्तिः आपको शोध में भाग लेने के लिए कोई प्रोत्साहन नहीं दिया जाएगा।

गोपनीयताः हम आपके बारे में जानकारी शोध दल के बाहर किसी के साथ साझा नहीं करेंगे इस शोध परियोजना से हम जो जानकारी एकत्र करते हैं उसे निजी रखा जाएगा। इसे अन्वेषक, अनुसंधान गाइड के अलावा किसी के साथ साझा या किसी को नहीं दिया जाएगा।

परिणाम साझा करनाः अध्ययन के अंत में, प्रासंगिक जानकारी आपके साथ साझा की जाएगी।

मना करने या वापस लेने का अधिकारः यदि आप ऐसा नहीं करना चाहते हैं तो आपको इस शोध में भाग लेने की आवश्यकता नहीं है। आप किसी भी समय शोध में भाग लेना बंद कर सकते हैं, भले ही आप पहले सहमत हों।

किससे संपर्क करेः यदि आपके कोई प्रश्न हैं, तो आप उनसे अभी या बाद में पूछ सकते हैं। यदि आप बाद में सवाल पूछना चाहते हैं, तो आप निम्नलिखित में से किसी से भी संपर्क कर सकते हैं!

Anjali Solanki (+91 9770749303; anjaliii0902@gmail.com) and Dr. Suneeta Chandorkar (+91 9426366666; suneetachandorkar@gmail.com)

सहमति का प्रमाण पत्रः मुझे शिफ्ट के काम में क्रोनोटाइप, भोजन और नींद के पैटर्न के बारे में शोध में भाग लेने के लिए आमंत्रित किया गया है। मैंने पूर्वगामी जानकारी पढ़ी है, या इसे मुझे पढ़ा गया है। मुझे इसके बारे में सवाल पूछने का अवसर मिला है और मैंने जो भी सवाल पूछे हैं, उनका जवाब मुझे संतोषजनक मिला है। मैं स्वेच्छा से इस अध्ययन में भाग लेने के लिए सहमत हूँ।

प्रतिभागी का नाम____________________ प्रतिभागी का हस्ताक्षर ____________

तारीख _______ शोधकर्ता/सहमति लेने वाले व्यक्ति का बयान।

मैंने संभावित प्रतिभागी के लिए सूचना पत्रक को सटीक रूप से पढ़ा है, और अपनी पूरी क्षमता के साथ यह सुनिश्चित किया है कि प्रतिभागी समझता है कि निम्नलिखित किया जाएगा।
समाज जनसांख्यिकी प्रोफाइल जानकारी पोषण स्थिति (एंथ्रोपोमेट्री) डेटा संग्रह क्रोनो प्रोफाइल जानकारी आहार जानकारी और शारीरिक गतिविधि डेटा स्क्रीन समय, तनाव और नींद डेटा संग्रह
मैं पुष्टि करता हूं कि प्रतिभागी को अध्ययन के बारे में प्रश्न पूछने की अनुमति दी गई थी, और प्रतिभागी द्वारा पूछे गए सभी प्रश्नों का सही और मेरी क्षमता के अनुसार उत्तर दिया गया है। मैं पुष्टि करता हूं कि व्यक्ति को सहमति देने के लिए मजबूर नहीं किया गया है, और सहमति स्वतंत्र रूप से और स्वेच्छा से दी गई है।

इस आई. सी. एफ. की एक प्रति प्रतिभागी को प्रदान की गई है! सहमति लेने वाले शोधकर्ता/व्यक्ति का नाम,

सहमति लेने वाले शोधकर्ता/व्यक्ति के हस्ताक्षर____________________

तारीख ______

સંમતિ ફોર્મ (Gujarati)

આ માહિતીસભર સંમતિ ફોર્મ વડોદરાથી સામાન્ય અને રોટેશનલ પાળીવાળા શિફ્ટ કામદારો માટે છે, જેમને અમે **"રોટેશનલ અને જનરલ શિફ્ટ કામદારોના ક્રોનો-ન્યુટ્રિશન પ્રોફાઈલ પર અભ્યાસ"** શીર્ષકવાળા સંશોધનમાં ભાગ લેવા માટે આમંત્રિત કરી રહ્યા છીએ.

રિસર્ચ ગાઇડ -

ડૉ. સુનીતા ચંદોરકર

આસિસ્ટન્ટ પ્રોફેસર

ડિપાર્ટમેન્ટ ઓફ ફૂડ્સ એન્ડ ન્યુટ્રિશન

ફેકલ્ટી ઓફ ફેમિલી એન્ડ કોમ્યુનિટી સાયન્સ

મહારાજા સયાજીરાવ યુનિવર્સિટી ઓફ બરોડા

તપાસકર્તા-

અંજલી સોલંકી

વિદ્યાર્થી, એમ. એસસી. ડાયટેટિક્સ

ડિપાર્ટમેન્ટ ઓફ ફૂડ્સ એન્ડ ન્યુટ્રિશન

ફેકલ્ટી ઓફ ફેમિલી એન્ડ કોમ્યુનિટી સાયન્સ

મહારાજા સયાજીરાવ યુનિવર્સિટી ઓફ બરોડા

પરિચયઃ

હું, અંજલી સોલંકી મહારાજા સયાજીરાવ યુનિવર્સિટી બરોડાના ખાદ્ય અને પોષણ વિભાગમાંથી એમ. એસ.સી. નો અભ્યાસ કરી રહી છું. મારા સંશોધન પ્રોજેક્ટનું શીર્ષક "રોટેશનલ અને જનરલ શિફ્ટ વર્કર્સના ક્રોન્યુટ્રિશન પ્રોફાઈલ પર અભ્યાસ" છે.

હું તમને માહિતી આપવા જઈ રહ્યો છું અને તમને આ સંશોધનમાં ભાગ લેવા આમંત્રણ આપું છું. તમે નિર્ણય કરો તે પહેલાં, સંશોધન વિશે તમે જેની સાથે આરામદાયક અનુભવો છો તેની સાથે વાત કરી શકો છો. આ સંમતિ ફોર્મમાં એવા શબ્દો હોઈ શકે છે જે તમે સમજી શકતા નથી. મહેરબાની કરીને મને રોકવા માટે કહો કારણ કે અમે માહિતીમાંથી પસાર થઈએ છીએ, અને હું સમજાવવા માટે સમય લઈશ. જો તમને પછીથી પ્રશ્નો હોય, તો તમે મને ફરીથી પૂછી શકો છો.

સંશોધનનો હેતુઃ

શિફ્ટ વર્ક એ વૈશ્વિક કાર્યબળનો એક આવશ્યક ઘટક છે, જેમાં 20 ટકા ઔદ્યોગિક રાષ્ટ્રો વ્યવસાયના કલાકોની બહાર કામ કરે છે. શિફ્ટ વર્કની કોઈ પ્રમાણભૂત વ્યાખ્યા નથી, તે સામાન્ય રીતે બિન-માનક કાર્ય સમયપત્રકનો સંદર્ભ આપે છે. શિફ્ટ વર્કની જરૂરિયાત મુખ્યત્વે 24/7 અર્થતંત્ર દ્વારા સંચાલિત છે, અને વૈશ્વિકીકરણના વિસ્તરણને કારણે તેમાં વધારો થવાની સંભાવના છે (બુચર ડેલા ટોરે એટ અલ. 2020; ચેંગ અને ડ્રેક 2018; વોંગ એટ અલ. 2019).

જો કે, તેણે શિફ્ટ કામદારની સર્કેડિયન લયને વિક્ષેપિત કરી છે અને આરોગ્યને અસર કરી છે. ડબ્લ્યુએચઓએ રાત્રિ પાળી કામદારોને સંભવિત કાર્સિનોજેન્સની યાદીમાં ઉમેર્યા છે. અમે શિફ્ટ કામદારોનો ક્રોનો પોષણ સાથે રોટેશનલ અને નિયમિત કામદારોનો સહસંબંધ શોધવા માંગીએ છીએ. અમે માનીએ છીએ કે તમે અમને તમારા આહારની રીત, ઊંઘની રીત, પ્રવૃત્તિની રીત અને સામાન્ય રીતે આરોગ્યની રીત વિશે જણાવીને મદદ કરી શકો છો.

સંશોધન હસ્તક્ષેપનો પ્રકાર: આ સંશોધનમાં પ્રશ્નાવલિ સામેલ હશે જે તમારે ભરવી પડશે અને તેમાં અડધો કલાકથી એક કલાકનો સમય લાગશે.

અમને તમારી પાસેથી નીચેની માહિતીની જરૂર પડશે: આહારની માહિતી, શારીરિક પ્રવૃત્તિ માહિતી, સ્ક્રીન ટાઇમ માહિતી, તણાવ સંબંધિત માહિતી અને ઊંઘ સંબંધિત માહિતી. (પ્રમાણભૂત પ્રશ્નાવલી અને ઇન્ટરવ્યૂ પદ્ધતિનો ઉપયોગ કરીને) ,એન્થ્રોપોમેટ્રિક ડેટા (ઊંચાઈ, વજન, શરીરની રચના)

સ્વૈચ્છિક ભાગીદારી: આ સંશોધનમાં તમારી ભાગીદારી સંપૂર્ણપણે સ્વૈચ્છિક છે. ભાગ લેવો કે નહીં તે તમારી પસંદગી છે.

પ્રક્રિયાઓ:

તમારે એક પ્રશ્નાવલી ભરવાની જરૂર છે જે અંજલિ સોલંકી દ્વારા પૂરી પાડવામાં આવશે અને એકત્રિત કરવામાં આવશે. તમે પ્રશ્નાવલીનો જવાબ જાતે આપી શકો છો, અથવા તે તમને વાંચી શકાય છે અને જો તમે ઇચ્છો કે હું તેને લખી લઉં તો તમે મોટેથી જવાબ આપી શકો છો.

જો તમે સર્વેક્ષણમાં સમાવિષ્ટ કોઇપણ પ્રશ્નોના જવાબ આપવા માંગતા નથી, તો તમે તેમને અવગણી શકો છો અને આગામી પ્રશ્ન પર આગળ વધી શકો છો. નોંધાયેલ માહિતી ગોપનીય

રહેશે, ફોર્મ પર તમારું નામ સામેલ કરવામાં આવશે નહીં, માત્ર એક નંબર તમને ઓળખશે, અને સંશોધન ટીમ સિવાય અન્ય કોઈની પાસે તમારી માહિતીની એક્સેસ હશે નહીં.

સમયગાળો/આવર્તનઃ ડેટા સંગ્રહ માટે સંશોધન પ્રોજેક્ટના સમગ્ર અભ્યાસક્રમ દરમિયાન આપણે બે વાર મળવાની જરૂર પડશે.

જોખમોઃ તેમાં કોઈ કથિત જોખમ સામેલ નથી.

લાભોઃ તમને કોઈ સીધો લાભ નહીં થાય, પરંતુ તમારી ભાગીદારી પાળીના કામ દરમિયાન ક્રોનો-પોષણના વ્યવસ્થાપનની વધુ સારી સમજણમાં ફાળો આપે તેવી શક્યતા છે.

વળતરઃ સંશોધનમાં ભાગ લેવા માટે તમને કોઈ પ્રોત્સાહન આપવામાં આવશે નહીં.

ગુપ્તતાઃ અમે તમારા વિશેની માહિતી સંશોધન ટીમની બહારના કોઈની સાથે શેર કરીશું નહીં આ સંશોધન પ્રોજેક્ટમાંથી અમે જે માહિતી એકત્રિત કરીએ છીએ તે ખાનગી રાખવામાં આવશે. તે તપાસકર્તા, સંશોધન માર્ગદર્શિકા સિવાય કોઈની સાથે વહેંચવામાં આવશે નહીં અથવા કોઈને આપવામાં આવશે નહીં.

પરિણામોઃ અભ્યાસના અંતે, સંબંધિત માહિતી તમારી સાથે શેર કરવામાં આવશે.

ઇનકાર કરવાનો અથવા પાછી ખેંચવાનો અધિકારઃ જો તમે આવું કરવા માંગતા ન હોવ તો તમારે આ સંશોધનમાં ભાગ લેવાની જરૂર નથી. જો તમે અગાઉ સંમત થયા હોવ તો પણ તમે કોઈપણ સમયે સંશોધનમાં ભાગ લેવાનું બંધ કરી શકો છો.

કોનો સંપર્ક કરવોઃ

જો તમારી પાસે કોઈ પ્રશ્નો હોય, તો તમે તેમને હમણાં અથવા પછી પૂછી શકો છો. જો તમે પછીથી પ્રશ્નો પૂછવા માંગતા હો, તો તમે નીચેનામાંથી કોઈપણનો સંપર્ક કરી શકો છોઃ

Anjali Solanki (+91 9770749303; anjaliii0902@gmail.com) and Dr. Suneeta Chandorkar (+91 9426366666; suneetachandorkar@gmail.com)

સંમતિનું પ્રમાણપત્રઃ

મને પાળીના કામમાં ક્રોનોટાઇપ, ભોજન અને ઊંઘની રીત વિશેના સંશોધનમાં ભાગ લેવા માટે આમંત્રિત કરવામાં આવ્યો છે. મેં ઉપરોક્ત માહિતી વાંચી છે, અથવા તે મને વાંચી સંભળાવવામાં આવી છે. મને તેના વિશે પ્રશ્નો પૂછવાની તક મળી છે અને મેં પૂછેલા કોઈપણ પ્રશ્નોના જવાબ મારા સંતોષ માટે આપવામાં આવ્યા છે. હું સ્વેચ્છાએ આ અભ્યાસમાં ભાગ લેવા માટે સંમત છું.

સહભાગીનું નામ _ સહભાગીની સહી _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ તારીખ _ _ _ _ _ _ _ _ _ _ સંશોધક/સંમતિ લેતી વ્યક્તિ દ્વારા નિવેદન.

મેં સંભવિત સહભાગીને માહિતી પત્રક સચોટપણે વાંચ્યું છે અને મારી શ્રેષ્ઠ ક્ષમતા મુજબ ખાતરી કરી છે કે સહભાગી સમજે છે કે નીચે મુજબ કરવામાં આવશે

• સોશિયોડેમોગ્રાફિક પ્રોફાઇલ માહિતી, પોષણની સ્થિતિ (એન્થ્રોપોમેટ્રી) ડેટા સંગ્રહ
• ક્રોનો પ્રોફાઇલ માહિતી, આહાર માહિતી અને શારીરિક પ્રવૃત્તિ ડેટા
• સ્ક્રીન ટાઇમ, સ્ટ્રેસ અને સ્લીપ ડેટા કલેક્શન

હું પુષ્ટિ કરું છું કે સહભાગીને અભ્યાસ વિશે પ્રશ્નો પૂછવાની મંજૂરી આપવામાં આવી હતી, અને સહભાગીએ પૂછેલા તમામ પ્રશ્નોના સાચા અને મારી શ્રેષ્ઠ ક્ષમતા મુજબ જવાબ આપવામાં આવ્યા છે. હું પુષ્ટિ કરું છું કે વ્યક્તિ પર સંમતિ આપવા માટે દબાણ કરવામાં આવ્યું નથી, અને સંમતિ મુક્તપણે અને સ્વેચ્છાએ આપવામાં આવી છે.આ ICF ની નકલ સહભાગીને આપવામાં આવી છે

સંમતિ લેનાર સંશોધક/વ્યક્તિનું નામ, સંશોધક/સંમતિ લેનાર વ્યક્તિની સહી ________________

તારીખ _____

Questionnaire for Research Title
"Study on Chrono-nutrition Profile of Regular and Rotational Shift workers"

1. Name: **2. Contact number:**

3. Age: **4. Gender: Male / Female/Others:**

5. Educational Qualification:

- **High School**
- **Diploma/Technical Education**
- **Bachelor's Degree**
- **Master's Degree and above**

6. Current Job Position:-

7. Work Shift Type:

- **General (Fixed)**
- **Rotational Shift (Changes weekly/monthly)**
- **Night Shift (Permanent)**

8. Duration of Employment in the Current Shift:

- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years

9. Your Shift Pattern of last 7days.Write down on which dates you have which

Shift Type	Date	Date	Date	Date	Date	Date	Date
General							
Morning							
Evening							
Night							
Off Day							

shift and off day: -

10. Level of Physical Activity during Work Hours:

- Sedentary (Mostly sitting)
- Light (Mostly standing/walking)
- Moderate (Frequent walking/standing with some lifting)
- High (Continuous movement, heavy lifting)

11. Where do you usually obtain your meals during work hours?

- Home-prepared meals
- Office canteen
- Food delivery services
- Nearby restaurants/food vendors

12. How often do you bring food from home to work?

- Never
- Rarely
- Sometimes
- Often
- Always

13. How often do you skip meals due to your work schedule?

- Never
- Rarely
- Sometimes
- Often
- Always

A. Diet Information:

1. You are:

- Vegetarian
- Eggetarian
- Non-vegetarian

3. Which is the most important meal of the day?

- Breakfast
- Lunch
- Snack
- Dinner

4. Meal Pattern and Timing as per Nature of work:

Meal	Meal time during the General shift	Meal time during the Morning shift	Meal time during the Evening shift	Meal time during the Night shift	Meal time during Off day
Breakfast					
Lunch					
Evening snack					
Dinner					

Write the time at which you eat that meal. For example, you have lunch at 11 am during your general shift so write 11 am in meal time during the general shift section in front of the lunch option. If you skip any meal write No or -

D. Chronotype & Chrono Profile:

- **Horne & Ostberg Morningness-Eveningness Questionnaire –**

1. When would you get up if you were entirely free to plan your day?	**On a free day**	**On a work day**
5:00 - 6:30 AM		
6:30 - 7:45 AM		
7:45 - 9:45 AM		
9:45 - 11:00 AM		
11:00 AM - 12:00 PM		
2. When would you go to bed if you were entirely free to plan your evening?	**On a free day**	**On a work day**
8:00 - 9:00 PM		
9:00 - 10:15 PM		
10:15 PM - 12:30 AM		
12:30 - 1:45 AM		
1:45 - 3:00 AM		
3. If there is a specific time at which you have to get up in the morning, to what extent do you depend on being woken up by an alarm clock?	**On a free day**	**On a work day**
Very dependent		
Fairly dependent		
Somewhat dependent		
Not at all dependent		

4. How easy do you find it to get up in the morning (when you are not woken by an alarm and are free to get up any time)?	**On a free day**	**On a work day**
Not at all easy		
Not very easy		
Fairly easy		
Very easy		
5. How hungry do you feel during the first half hour after you wake up?	**On a free day**	**On a work day**
Not at all hungry		
Slightly hungry		
Fairly hungry		
Very hungry		
6. During the first half hour after you wake up in the morning, how tired do you feel?	**On a free day**	**On a work day**
Very tired		
Fairly tired		
Fairly refreshed		
Very refreshed		
7. If you had no commitments the next day, what time would you go to bed compared to your usual bedtime?	**On a free day**	**On a work day**
8:00 - 9:00 PM		
9:00 - 10:15 PM		
10:15 PM - 12:30 AM		
12:30 - 1:45 AM		
8. You have decided to engage in some physical exercise. A friend suggests that you do this for one hour twice a week and the best time for you is between 7:00 - 8:00 AM. How do you think you would perform?	**On a free day**	**On a work day**
Would be in good form		
Would be in reasonable form		
Would find it difficult		
Would find it very difficult		
9. Approximately when would you go to bed if you could sleep when you felt like it?	**On a free day**	**On a work day**
8:00 PM–9:00 PM		
9:00 PM–10:15 PM		
10:15 PM–12:45 AM		
12:45 AM–2:00 AM		
2:00 AM–3:00 AM		

10. You want to be at your peak performance for your work that you know is going to be mentally exhausting and will last two hours. Which one of the four working times would you choose? You are entirely free to plan your day.	On a free day	On a work day
8 AM–10 AM		
11 AM–1 PM		
3 PM–5 PM		
7 PM–9 PM		
11. If you went to bed at 11 PM , how tired would you be?		
Not at all tired		
A little tired		
Fairly tired		
Very tired		
12.For some reason, you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which one of the following are you most likely to do?	**On a free day**	**On a work day**
Wake up at your usual time, but not fall back asleep		
Wake up at your usual time, and doze thereafter		
Wake up at your usual time, but fall asleep again		
Not wake up until later than usual		
13. One night you have to remain awake between 4-6 AM to do your work and the next day is a holiday. Which one of these alternatives would suit you best?	**On a free day**	**On a work day**
Stay up until the watch is over		
Take a nap before the watch, and sleep after		
Have a good sleep before the watch, and nap after		
Sleep only before the watch		
14. You have two hours of hard physical work. You are entirely free to plan your day. What time will you choose to do it ?	**On a free day**	**On a work day**
8 AM–10 AM		
11 AM–1 PM		
3 PM–5 PM		
7 PM–9 PM		
15. You have decided to exercise. A friend suggests that you do this for one hour twice a week between 10-11 PM. Will you be able to do it easily or not?	**On a free day**	**On a work day**
Would be in good form		
Would be in reasonable form		
Would find it difficult		
Would find it very difficult		
16. Assume that you work a five-hour day (including breaks), at approximately what time would you choose to begin?	**On a free day**	**On a work day**

5 hours starting between 4–9 AM		
5 hours starting between 9 AM–2 PM		
5 hours starting between 2–7 PM		
5 hours starting between 7 PM– 12 AM		
17. At what time of day do you think you reach your maximum alertness?	**On a free day**	**On a work day**
5–8 AM		
8–10 AM		
10 AM–5 PM		
5–10 PM		
10 PM–5 AM		
18. Are you a "morning type" or an "evening type"?		
Definitely a morning type		
Rather more a morning type than an evening type		
Rather more an evening type than a morning type		
Definitely an evening type		

- **Work Details:**

Noture of work	Time at which you go to bed	Time at which Get ready to fall asleep	Time taken to fall asleep	Wake up time	Time taken to get up	Wake up with	Do you take nap? Tick your answer	If yes write time	Are you able to choose your sleep time	If yes, what's the reason

In the last 3 months, I worked as a shift worker.

- No
- Yes

If you are a general fixed shift employee then mention your usual work schedule starts at _________ o´clock. Ends at _________ o´clock.

My work schedules are

- very flexible
- a little flexible
- rather inflexible
- very inflexible

I travel to work

- by car, bus, bike
- by cycle
- by walk

For the commute to work, I need ___ hours and ___ minutes.
For the commute from work, I need ___ hours and ___ minutes

- **Munich Chronotype Questionnaire for Rotational Shift Workers (MCTQShift)**

  The following questions concern your sleep- and wake behaviour on work days and free days. Please answer them about your current shift schedule, i.e. not all combinations have to be filled out! Also, please reply with regards to the current season (i.e., the last 6 weeks). Please try to answer ALL questions, even when an answer seems difficult! Spontaneous answers are often the best. Please help us in the

General							Yes/No		Yes No	Children Hobbies Others
Mornin g							Yes/No			Children Hobbies Others
Evening							Yes/No			Children Hobbies Others
Night							Yes/No			Children Hobbies Others
Off day							Yes/No			Children Hobbies Others

evaluation of your data by providing unambiguous time references (e.g. 23:00 rather than 11:00 PM).

- **Stimulants-**

	Per day	Per week	Per month
I smoke _____ cigarettes			
I drink _____ cups of coffee			
I drink _____ cups of tea			
I drink _____ cans of caffeinated drinks (soft-drinks)			
I take sleep medication _____ times			

E. Global physical activity questionnaire:

Physical Activity	Tick your answer	If yes, Activity Type	Days per week	How much time per day
Vigorous activities like carrying heavy loads/running/football for a minimum of 10 minutes	Yes No	Carrying heavy loads Football Running Other -		Hours: Minutes:

Moderate activities like brisk walking or carrying light loads /cycling/swimming/volleyball at least for 10minutes	Yes No	Carrying light loads Cycling Swimming Other -		Hours: Minutes:
Travel to and from the places	Yes No	Bicycle Walk		Hours: Minutes:
Sitting	Yes No			Hours: Minutes:

F. Perceived Stress Scale Questionnaire:

0 – never, 1 - almost never, 2 – sometimes, 3 - fairly often, 4 very often

1) In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2) In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3) In the last month, how often have you felt nervous and stressed?	0	1	2	3	4
4) In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5) In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6) In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7) In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8) In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9) In the last month, how often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
10) In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

G. Pittsburgh Sleep Quality Index:

1) At what hour have you usually gone to bed?	
>10pm	1
10-10:59pm	2
11-11:59pm	3
12-12:59pm	4
1-1:59pm	5
2-2:59pm	6
<3pm	7

2) During the past month, how often have you had trouble sleeping because you…		Not During The past month (1)	Less Than One Week (2)	Once Or Twice A week (3)	Three Or more Times a Week (4)	Never (5)
i.	1) Cannot get to sleep within 30 minutes					
ii.	2) Wake up in the middle of the night or early morning					
iii.	3) Have to get up to use the bathroom					
iv.	4) Cannot breathe comfortably					
v.	5) Cough or snore loudly					
vi.	6) Feel too cold					
vii.	7) Feel to hot					
viii.	8) Had bad dreams					
ix.	9) Have Pain					
x.	10) Other reasons, please describe					
xi.	How often during the past month have you had trouble sleeping because of this?					
3) If You have a roommate or bed partner, Ask him/her how often in the past month you have had…		No Bed partner or roommate (1)	Partner / Roommate in the other room(2)	Partner In same Room but not Same bed (3)	Partner in same Bed (4)	Write yes or No if you have
a)	Loud Snoring					
b)	Long Pauses between Breathes while sleep					
c)	Legs switching or jerking while you sleep					
d)	Episodes of disorientation or confusion during sleep					

Screen use on an average weekday Thinking of an average weekday (from when you wake up until you go to sleep), how much time do you spend using each of the following types of screen as the primary activity? You must answer both hours and minutes. **If zero please type "0" in the box.**		
	Hours	Minutes
Television		
TV-connected devices (e.g. streaming devices, video game consoles)		
Laptop/computer		
Smartphone		
Tablet		

H. Screen Time:

Screen use on an average weekend day Now, thinking of an average weekend day (Saturday or Sunday), how many hours over the course of the whole day (from when you wake up until you go to sleep) do you spend using each of the following types of screen as the primary activity? You must answer both hours and minutes. **If zero please type "0" in the box**.		
	Hours	Minutes
Television		
TV-connected devices (e.g. streaming devices, video game consoles)		
Laptop/computer		
Smartphone		
Tablet		

Screen use on an average weeknight Now, thinking of an average weeknight (from when you return from work until you go to sleep), how much time do you spend using each of the following types of screen as the primary activity? You must answer both hours and minutes. **If zero please type "0" in the box.**		
	Hours	Minutes
Television		
TV-connected devices (e.g. streaming devices, video game consoles)		
Laptop/computer		
Smartphone		
Tablet		

For the following set of questions, **background screen** is defined as the use of a television or another screen near you while performing other activities such as exercising, cooking, and interacting with family/friends. Thinking about a regular weekday (Monday through Friday), on average, how many hours **over the course of the whole day** (from when you wake up until you go to sleep) are you exposed to background screen use?
Example: If you exercise in the morning for one hour while watching the TV news, you use

your smartphone for one hour while eating lunch and an additional 30 minutes while eating dinner, you would estimate that you are exposed to 2 hours and 30 minutes of background screen use per day.

	Hours	Minutes
Background screen use on a regular weekday		
Background screen use on a regular weeknight		
Background screen use on a regular weekend day		

I. Sitting Time:

Category of Risk	Hours of sitting
Low risk	<4 Hours /day
Medium risk	4-8 hours /day
High risk	8-11 hours /day
Very High risk	>11 hours /day

शोध के लिए प्रश्न शीर्षक-"सामान्य और रोटेशनल शिफ्ट श्रमिकों के कालानुक्रमिक पोषण प्रोफाइल पर अध्ययन"

निर्देशः फॉर्म को अपनी पसंदीदा भाषा-हिंदी/गुजराती में भरें और अपने उत्तर के बुलेट पॉइंट पर टिक करें और कृपया अपने साथ पेन लाएं|

1. नाम - **2. संपर्क नंबर-**

3. उम्र: - **4. लिंग: पुरुष / महिला /अन्य**

5. शैक्षिक योग्यता:

- □ a) 1-9वीं पास
- □ b) 10वीं-12वीं पास
- □ c) डिप्लोमा
- □ d) ग्रेजुएट

6. आपकी वर्तमान नौकरी की स्थिति –

- □ a) कार्यकर्ता
- □ b) सुपरवाइज़र
- □ c) प्रशासन

7. कार्य स्थानांतरण प्रकारः

- □ a) जनरल
- □ b) शिफ्ट ड्यूटी
- □ c) रात्रि

8. कितने समय से आप वर्तमान शिफ्ट में काम कर रहे हैं :

- □ a) 1-3 वर्ष
- □ b) 3-5 वर्ष
- □ c) 5 वर्ष से अधिक

9. पिछले सप्ताह का आपका शिफ्ट पैटर्न:

शिफ्ट प्रकार	रविवार	सोमवार	मंगलवार	बुधवार	गुरुवार	शुक्रवार	शनिवार
A) **जनरल**							
छुट्टी के दिन							
B) **सुबह**							
छुट्टी के दिन							
C) **शाम**							
छुट्टी के दिन							
D) **रात**							
छुट्टी के दिन							

10. कार्य घंटों के दौरान शारीरिक गतिविधि का स्तरः-

- □ a) ज्यादातर बैठना
- □ b) ज्यादातर खड़ा होना/चलना
- □ c) बार-बार चलना/कुछ उठाने के साथ खड़ा होना
- □ d) निरंतर गति, भारी सामान उठाना

11. आप आम तौर पर काम के घंटों के दौरान अपना भोजन कहाँ से प्राप्त करते हैं?

- □ a) घर में तैयार भोजन
- □ b) ऑफिस कैंटीन
- □ c) भोजन वितरण सेवाएँ (जोमैटो/स्विगी)
- □ d) आस-पास के भोजन की दुकान

12. आप घर से काम पर कितनी बार खाना लाते हैं?

- □ a) कभी नहीं
- □ b) शायद ही कभी
- □ c) कभी कभी
- □ d) अक्सर
- □ e) हमेशा

13. क्या आप अपने काम की पाली के कार्यक्रम के आधार पर अपनी भूख में कोई बदलाव देखते हैं?

- ☐ a) हाँ, मैं रात की शिफ्ट के दौरान अधिक खाता हूँ
- ☐ b) हाँ, मैं रात की शिफ्ट के दौरान कम खाता हूँ
- ☐ c) नहीं, मेरी भूख लगातार बनी रहती है
- ☐ d) निश्चित नहीं

14. आप अपने कार्य के कारण कितनी बार भोजन छोड़ते हैं?

- ☐ a) कभी नहीं
- ☐ b) शायद ही कभी
- ☐ c) कभी कभी
- ☐ d) अक्सर
- ☐ e) हमेशा

A. Diet Information:

1.आप

- ☐ a) शाकाहारी
- ☐ b) शाकाहारी+अंडा
- ☐ c) मांसाहारी

2. दिन का सबसे महत्वपूर्ण भोजन कौन सा है?

- ☐ a) सुबह का नाशता
- ☐ b) दोपहर का भोजन
- ☐ c) शाम का नाशता
- ☐ d) रात का खाना

3. कार्य की प्रकृति के अनुसार भोजन का स्वरूप और समयः

भोजन का स्वरूप	i) जनरल शिफ्ट के दौरान भोजन का समय	ii) सुबह की शिफ्ट के दौरान भोजन का समय	ii) शाम की शिफ्ट के दौरान भोजन का समय	iv) रात की शिफ्ट के दौरान भोजन का समय	v) छुट्टी के दिन भोजन का समय
A) सुबह का नाशता					
B) दोपहर का भोजन					
C) शाम का नाश्ता					
D) रात का खाना					

उस समय को लिखें जब आप उस भोजन को खाते हैं। उदाहरण के लिए, आप अपनी सामान्य शिफ्ट के दौरान सुबह 11 बजे दोपहर का भोजन करते हैं, इसलिए दोपहर के भोजन के विकल्प के सामने सामान्य पाली के दौरान भोजन के समय में सुबह 11 बजे लिखें। यदि आप कोई भी भोजन छोड़ देते हैं तो ना लिखें या –

B. Chronotype & Chrono Profile: Horne & Ostberg Morningness-Eveningness Ques.:

1.यदि आप अपने दिन की योजना बनाने के लिए पूरी तरह से स्वतंत्र हैं तो आप कब उठेंगे?	छुट्टी के दिन (Z)	
a) 5:00 - 6:30 AM		
b) 6:30 - 7:45 AM		
c) 7:45 - 9:45 AM		
d) 9:45 - 11:00 AM		
e) 11:00 AM - 12:00 PM		
2. अगर आप अपनी शाम की योजना बनाने के लिए पूरी तरह से	छुट्टी के	

स्वतंत्र होते तो आप कब सोते?	दिन (Z)	
a) 8:00 - 9:00 PM		
b) 9:00 - 10:15 PM		
c) 10:15 PM - 12:30 AM		
d) 12:30 - 1:45 AM		
e) 1:45 - 3:00 AM		
3. यदि कोई विशिष्ट समय है जिस पर आपको सुबह उठना है, तो आप अलार्म घड़ी से जागने पर किस हद तक निर्भर हैं?		काम के दिन(Y)
a) बहुत निर्भर		
b) काफी निर्भर		
c) कुछ हद तक निर्भर		
d) बिल्कुल भी निर्भर नहीं		
4. आपको सुबह उठना कितना आसान लगता है (जब आप अलार्म से नहीं जागते हैं और किसी भी समय उठने के लिए स्वतंत्र होते हैं)?		काम के दिन(Y)
a) बिलकुल भी आसान नहीं		
b) बहुत आसान नहीं		
c) काफी आसान		
d) बहुत आसान		
5. जागने के बाद पहले आधे घंटे के दौरान आप कितना सतर्क महसूस करते हैं?	छुट्टी के दिन	काम के दिन
a) बिलकुल तरोताजा महसूस नहीं करना		
b) थोड़ा तरोताजा महसूस करना		
c) काफी तरोताजा महसूस करना		
d) बहुत तरोताजा महसूस करना		
6. जागने के बाद पहले आधे घंटे में आपको कितनी भूख लगती है?	छुट्टी के दिन	काम के दिन
a) भूख बिल्कुल नहीं लगती।		
b) थोड़ी भूख लग रही है		

c) काफी भूख लग रही है		
d) बहुत भूख लग रही है		
7. सुबह उठने के बाद पहले आधे घंटे में आप कितना थका हुआ महसूस करते हैं?	छुट्टी के दिन	काम के दिन
a) बहुत थका हुआ।		
b) काफी थका हुआ है।		
c) काफी ताज़ा		
d) बहुत ताज़ा		
8. अगर अगले दिन आपकी कोई प्रतिबद्धता नहीं थी, तो आप अपने सामान्य सोने के समय की तुलना में कितने बजे सोएँगे?	छुट्टी के दिन	काम के दिन
a) 8:00 - 9:00 PM		
b) 9:00 - 10:15 PM		
c) 10:15 PM - 12:30 AM		
9. आपने कुछ शारीरिक व्यायाम करने का फैसला किया है। एक दोस्त का सुझाव है कि आप सप्ताह में दो बार एक घंटे के लिए ऐसा करें और आपके लिए सबसे अच्छा समय सुबह 7 बजे से 8 बजे के बीच है। आपको क्या लगता है कि आप कैसा प्रदर्शन करेंगे?		
a) अच्छा प्रदर्शन करेंगे।		
b) उचित प्रदर्शन करेंगे		
c) मुश्किल लगेगी		
d) यह बहुत मुश्किल होगा		
10. यदि आप अपनी इच्छा के अनुसार सो सकते हैं तो आप लगभग कब सोएँगे?		
a) 8:00 PM–9:00 PM		
b) 9:00 PM–10:15 PM		
c) 10:15 PM–12:45 AM		
d) 12:45 AM–2:00 AM		
e) 2:00 AM–3:00 AM		
11. आप अपने काम के लिए अपने चरम प्रदर्शन पर रहना चाहते हैं		

जो आपको पता है कि मानसिक रूप से थका देने वाला है और दो घंटे तक चलेगा। आप चार कार्य समयों में से कौन सा समय चुनेंगे? आप अपने दिन की योजना बनाने के लिए पूरी तरह से स्वतंत्र हैं।		
a) 8 AM–10 AM		
b) 11 AM–1 PM		
c) 3 PM–5 PM		
d) 7 PM–9 PM		
12. अगर आप रात 11 बजे सोने जाते है, तो आप कितने थके हुए होते हैं		
a) बहुत थका हुआ।		
b) काफी थका हुआ है।		
c) काफी ताज़ा		
d) बहुत ताज़ा		
13. किसी कारण से, आप सामान्य से कई घंटे देर से सोने गए हैं, लेकिन अगली सुबह किसी विशेष समय पर उठने की आवश्यकता नहीं है। आप निम्नलिखित में से किसके करने की सबसे अधिक संभावना रखते हैं?		
a) अपने सामान्य समय पर जागो, लेकिन वापस सो मत जाओ		
b) अपने सामान्य समय पर जागो, और उसके बाद सो जाओ		
c) अपने सामान्य समय पर जागो, लेकिन फिर से सो जाओ		
d) सामान्य से देर तक मत जागो		
14. एक रात आपको अपना काम करने के लिए सुबह 4 से 6 बजे के बीच जागना पड़ता है और अगले दिन छुट्टी होती है। इनमें से कौन सा विकल्प आपको सबसे अच्छा लगेगा?		
a) जब तक काम खत्म न हो जाए तब तक जागते रहें		
b) काम से पहले झपकी लें और उसके बाद सो जाएं।		
c) काम से पहले अच्छी नींद लें, और उसके बाद झपकी लें।		
d) काम से पहले ही सोएँ।		
15. आपके पास दो घंटे की कड़ी शारीरिक मेहनत है। आप अपने		

दिन की योजना बनाने के लिए पूरी तरह से स्वतंत्र हैं। इसे करने के लिए आप किस समय को चुनेंगे?		
16. आपने व्यायाम करने का फैसला किया है। एक दोस्त का सुझाव है कि आप 10-11 PM के बीच सप्ताह में दो बार एक घंटे के लिए ऐसा करें। क्या आप इसे आसानी से कर पाएंगे या नहीं?		
a) अच्छा प्रदर्शन करेंगे।		
b) उचित प्रदर्शन करेंगे		
c) मुश्किल लगेगी		
d) यह बहुत मुश्किल होगा		
17. मान लीजिए कि आप दिन में पाँच घंटे काम करते हैं (ब्रेक सहित), आप लगभग किस समय शुरू करना चाहेंगे?		
a) 4–8 AM		
b) 8–9 AM		
c) 9 AM–2 PM		
d) 2–5 PM		
e) 5 PM–4 AM		
18. आपको क्या लगता है कि आप दिन के किस समय अपनी अधिकतम सतर्कता तक पहुँचते हैं?		
a) 5–8 AM		
b) 8–10 AM		
c) 10 AM–5 PM		
d) 5–10 PM		
e) 10 PM–5 AM		
19. क्या आप "मॉर्निंग टाइप" या "इवनिंग टाइप" हैं?		
a) निश्चित रूप से सुबह जल्दी जागने वाला व्यक्ति		
b) बल्कि मैं सुबह जल्दी उठने वाले प्रकार के व्यक्ति की तुलना में देर रात सोने वाले प्रकार का व्यक्ति हूं।		
c) निश्चित रूप से देर रात सोने वाला व्यक्ति		

C. Work Details-

1. पिछले 3 महीनों में, मैंने एक शिफ्ट कर्मचारी के रूप में काम किया।

- a) हां
- b) नहीं

2. मेरा सामान्य कार्य _ _ _ _ _ _ _ _ _ _ _ बजे शुरू होता है. _ _ _ _ _ _ _ _ _ _ _ बजे समाप्त होता है।.

3. मेरा काम का समय

- a) बहुत अनुकूल
- b) थोड़ा अनुकूल
- c) बल्कि अनुकूल
- d) बिल्कुल भी अनुकूल नहीं है

4. मैं काम पर जाता हूँ-

- a) जैसे कार, बस, बाइक
- b) साइकिल से
- c) पैदल

5. काम पर जाने के लिए, मुझे _ __ ___ घंटे और _ ____ _ मिनट चाहिए।

6. काम से आने के लिए, मुझे _ ____ _ घंटे और _ _ ___ मिनट चाहिए

D. उत्तेजक –

	i)प्रतिदिन	ii) प्रति सप्ताह	iii) प्रति माह
A) मैं _ _ _ _ _ सिगरेट पीता हूँ।			
B) मैं _ _ _ _ _ कप कॉफी पीता हूँ।			
C) मैं _ _ _ _ कप चाय पीता हूँ।			
D) मैं कैफ़ीन युक्त पेय (कार्बोनेटेड पेय) के _ _ _ _ _ डिब्बे पीता हूँ।			
E) मैं नींद की दवा _ _ _ _ _ बार लेता हूँ।			

E. Global Physical Activity Questionnaire:

i) शारीरिक गतिविधि	**ii) अपने जवाब पर टिक लगाएँ**	**iii) यदि हाँ, तो गतिविधि का प्रकार**	**iv) सप्ताह के दिन**	**v) प्रति दिन कितना समय**
A) कम से कम 10 मिनट के लिए भारी भार ले जाने/दौड़ने/फुटबॉल जैसी जोरदार गतिविधियाँ।	हा/ना	भारी भार उठाकर फुटबॉल दौड़ना अन्य -		
B) कम से कम 10 मिनट के लिए तेज चलना या हल्का भार ले जाना/साइकिल चलाना /तैराकी/ वॉलीबॉल जैसी मध्यम गतिविधियाँ	हा/ना	हल्का भार उठाकर साइकिल चलाना तैराकी अन्य -		
C) स्थानों पर आना-जाना	हा/ना	साइकिल चलाना		
D) बैठना	हा/ना			

F. Perceived Stress Scale Questionnaire:

0-कभी नहीं, 1-लगभग कभी नहीं, 2-कभी-कभी, 3-काफी बार, 4 बहुत बार

1) पिछले महीने में, अप्रत्याशित रूप से हुई किसी घटना के कारण आप कितनी बार परेशान हुए हैं?	0	1	2	3	4
2) पिछले महीने में, आपने कितनी बार महसूस किया है कि आप अपने जीवन में महत्वपूर्ण चीजों को नियंत्रित करने में असमर्थ थे?	0	1	2	3	4
3) पिछले महीने में आपने कितनी बार घबराहट और तनाव महसूस किया है?	0	1	2	3	4
4) पिछले महीने में, आपने अपनी व्यक्तिगत समस्याओं को संभालने की अपनी क्षमता के बारे में कितनी बार आत्मविश्वास महसूस किया है?	0	1	2	3	4
5) पिछले महीने में, आपने कितनी बार महसूस किया है कि चीजें आपके अनुसार चल रही थीं?	0	1	2	3	4
6) पिछले महीने में, आपने कितनी बार पाया है कि आप उन सभी चीजों का सामना नहीं कर सके जो आपको करनी थीं?	0	1	2	3	4
7) पिछले महीने में आप अपने जीवन में कितनी बार चिड़चिड़ापन को नियंत्रित कर पाए हैं?	0	1	2	3	4
8) पिछले महीने में, आपने कितनी बार महसूस किया है कि आप चीजों के शीर्ष पर थे?	0	1	2	3	4
9) पिछले महीने में, आप कितनी बार उन चीजों के कारण क्रोधित हुए हैं जो आपके नियंत्रण से बाहर थीं?	0	1	2	3	4
10) पिछले महीने में, आपने कितनी बार महसूस किया है कि कठिनाइयाँ इतनी अधिक हो रही थीं कि आप उन्हें दूर नहीं कर सके?	0	1	2	3	4

G. Sitting Time:

जोखिम की श्रेणी	बैठने के घंटे	अपने जवाब पर टिक करें
a) कम जोखिम	<4 घंटे प्रति दिन	
b) मध्यम श्रेणी का जोखिम	4-8 घंटे प्रति दिन	
c) उच्च जोखिम	8-11 घंटे प्रति दिन	
d) बहुत अधिक जोखिम	>11 घंटे प्रति दिन	

H. Pittsburgh Sleep Quality Index:

1) आप आमतौर पर किस समय सोने जाते हैं?	
>10 बजे	1
10-10:59 बजे	2
11-11:59 बजे	3
12-12:59 बजे	4
1-1:59 बजे	5
2-2:59 बजे	6
<3 बजे	7

2) पिछले महीने के दौरान, आपको आमतौर पर हर रात सोने में कितना समय (मिनट में) लगा है?

मिनटों की संख्या ___

3) पिछले महीने के दौरान, आप आमतौर पर सुबह कब उठते हैं? सामान्य समय पर उठना _____

4) पिछले महीने के दौरान, आपको रात में कितने घंटे की वास्तविक नींद मिली? (यह आपके द्वारा बिस्तर पर बिताए गए घंटों की संख्या से अलग हो सकता है)। प्रति रात नींद के घंटे ___

5) पिछले महीने के दौरान, आपकी वजह से आपको कितनी बार सोने में परेशानी हुई है।	पिछले महीने के दौरान नहीं (1)	एक सप्ताह से कम (2)	सप्ताह में एक या दो बार (3)	सप्ताह में तीन या अधिक बार (4)	कभी नहीं (5)
a) 30 मिनट के भीतर सो नहीं सकता					
b) आधी रात या सुबह जल्दी उठें।					
c) शौचालय का उपयोग करने के लिए उठना पड़ता है					
d) आराम से सांस नहीं ले सकते।					
e) जोर से खाँसी या खर्राटे लेना					
f) बहुत ठंड लगना					
g) बहुत गर्म महसूस करें					
h) बुरे सपने देखे थे					
I) दर्द हो रहा है					
j) अन्य कारणों का कृपया वर्णन करें।					
k) पिछले महीने के दौरान आपको कितनी बार इस वजह से सोने में परेशानी हुई है?					

I. Screen Time:	6) यदि आपका कोई रूममेट या बेड पार्टनर है, तो उससे पूछें कि पिछले महीने में आपने कितनी बार ऐसा किया है।	कोई बेड पार्टनर या रूममेट नहीं (1)	दूसरे कमरे में साथी/रूम मेट (2)	एक ही कमरे में साथी लेकिन नहीं एक ही बिस्तर (3)	एक ही बिस्तर पर साथी (4)	कभी नहीं (5)
	a) ज़ोर से खर्राटे लेना					
	b) सोते समय सांस लेने के बीच लंबा विराम					
	c) सोते समय पैर बदलते या झटके लगते हैं।					
	d) नींद के दौरान भटकाव या भ्रम के एपिसोड					

A) एक औसत कार्यदिवस पर स्क्रीन का उपयोग एक औसत कार्यदिवस के बारे में सोचते हुए (जब आप जागते हैं और जब आप सोते हैं), आप प्राथमिक गतिविधि के रूप में निम्नलिखित में से प्रत्येक प्रकार के स्क्रीन का उपयोग करने में कितना समय बिताते हैं? आपको घंटे और मिनट दोनों का जवाब देना होगा। यदि शून्य है तो कृपया बॉक्स में "0" टाइप करें।			
		घंटे	मिनट्स
I.	टेलीविजन		
II.	टीवी से जुड़े उपकरण (जैसे स्ट्रीमिंग उपकरण, वीडियो गेम कंसोल)		
III.	लैपटॉप/कंप्यूटर		
IV.	स्मार्टफोन		
V.	टेबलेट		
B) एक औसत सप्ताह की रात में स्क्रीन का उपयोग अब, एक औसत सप्ताह की रात के बारे में सोचते हुए (जब आप काम से लौटते हैं और जब आप सोने जाते हैं), आप प्राथमिक गतिविधि के रूप में निम्नलिखित में से प्रत्येक प्रकार के स्क्रीन का उपयोग करने में कितना समय बिताते हैं? आपको घंटे और मिनट दोनों का जवाब देना होगा।यदि शून्य है तो कृपया बॉक्स में "0" टाइप करें।			
		घंटे	मिनट्स
I.	टेलीविजन		
II.	टीवी से जुड़े उपकरण (जैसे स्ट्रीमिंग उपकरण, वीडियो गेम कंसोल)		

III. लैपटॉप/कंप्यूटर		
IV. स्मार्टफोन		
V. टेबलेट		
C) औसत सप्ताहांत के दिन स्क्रीन का उपयोग औसत सप्ताहांत के दिन स्क्रीन का उपयोग अब, एक औसत सप्ताहांत के दिन (शनिवार या रविवार) के बारे में सोचते हुए, पूरे दिन के दौरान कितने घंटे (जब आप जागते हैं तो आप सोने जाते हैं) क्या आप प्राथमिक गतिविधि के रूप में निम्नलिखित में से प्रत्येक प्रकार के स्क्रीन का उपयोग करने में खर्च करते हैं? आपको घंटे और मिनट दोनों का जवाब देना होगा। यदि शून्य है तो कृपया बॉक्स में "0" टाइप करें।		

	घंटे	मिनट्स
I. टेलीविजन		
II. टीवी से जुड़े उपकरण (जैसे स्ट्रीमिंग उपकरण, वीडियो गेम कंसोल)		
III. लैपटॉप/कंप्यूटर		
IV. स्मार्टफोन		
V. टेबलेट		
	घंटे	मिनट्स
D) सप्ताह के नियमित दिनों में पृष्ठभूमि स्क्रीन का उपयोग		
E) सप्ताह की नियमित रात में पृष्ठभूमि स्क्रीन का उपयोग करें		
F) नियमित सप्ताहांत के दिन पृष्ठभूमि स्क्रीन का उपयोग करें		

निम्नलिखित प्रश्नों के लिए, पृष्ठभूमि स्क्रीन को व्यायाम, खाना पकाने और परिवार/दोस्तों के साथ बातचीत करने जैसी अन्य गतिविधियों को करते समय आपके पास एक टेलीविजन या किसी अन्य स्क्रीन के उपयोग के रूप में परिभाषित किया गया है। एक नियमित कार्यदिवस (सोमवार से शुक्रवार) के बारे में सोचते हुए, पूरे दिन के दौरान औसतन कितने घंटे (जब आप जागते हैं तब से जब आप सोते हैं) क्या आप पृष्ठभूमि स्क्रीन के उपयोग के संपर्क में हैं?

उदाहरण के लिए: यदि आप सुबह टीवी समाचार देखते हुए एक घंटे के लिए व्यायाम करते हैं, तो आप दोपहर का भोजन करते समय एक घंटे के लिए अपने स्मार्टफोन का उपयोग करते हैं और रात का खाना खाते समय अतिरिक्त 30 मिनट का उपयोग करते हैं, तो आप अनुमान लगाएंगे कि आप प्रति दिन 2 घंटे और 30 मिनट के पृष्ठभूमि स्क्रीन उपयोग के संपर्क में हैं।

ONLY FOR ROTATIONAL SHIFT WORKERS

J. Munich Chronotype Questionnaire for Rotational Shift Workers: -

निम्नलिखित प्रश्न कार्य दिवसों और खाली दिनों में आपकी नींद और जागने के व्यवहार से संबंधित हैं। कृपया उन्हें अपने वर्तमान शिफ्ट कार्यक्रम के बारे में जवाब दें, यानी सभी संयोजनों को भरने की आवश्यकता नहीं है! इसके अलावा, कृपया वर्तमान सत्र (यानी पिछले 6 सप्ताह) के संबंध में जवाब दें। कृपया सभी प्रश्नों का उत्तर देने का प्रयास करें, भले ही कोई उत्तर कठिन लगे! हा और नहीं जवाब में अपने उत्तर पर गोला लगायें

कार्य प्रकृति	जिस समय आप सोने जाते हैं	वह समय जब आप सोने के लिए तैयार हों	सोने में लगने वाला समय	जागने का समय	जागने में लगने वाला समय	क्या आप अलार्म बजने से जागते हैं? अपने उत्तर पर गोला लगायें	क्या आप झपकी लेते हैं?अपने उत्तर पर गोला लगायें	यदि हाँ, तो समय लिखें	क्या आप अपनी नींद का समय खुद चुन सकते हैं?	यदि हाँ, तो क्या कारण है?
सामान्य						हा/ना	हा/ना		हा/ना	बच्चे शौक अन्य
सुबह						हा/ना	हा/ना		हा/ना	बच्चे शौक अन्य
शाम की						हा/ना	हा/ना		हा/ना	बच्चे शौक अन्य
रात						हा/ना	हा/ना		हा/ना	बच्चे शौक अन्य
छुट्टी का दिन						हा/ना	हा/ना		हा/ना	बच्चे शौक अन्य

<u>સંશોધન શીર્ષક માટેની પ્રશ્નાવલીઃ "જનરલ અને રોટેશનલ શિફ્ટ કામદારોની ક્રોનો-પોષણ રૂપરેખા પર અભ્યાસ"</u>

સૂચનાઓઃ તમારી પસંદગીની ભાષા-હિન્દી/ગુજરાતીમાં ફોર્મ ભરો અને તમારો જે જવાબ હોય બિંદુ પર ટિક કરો.અને કૃપા કરીને સાથે પેન રાખવા વિનંતી.

1. નામ- **2. સંપર્ક નંબર-**

3. ઉંમરઃ- **4. જાતિઃ પુરુષ / સ્ત્રી / અન્ય**

5. શૈક્ષણિક લાયકાતઃ

- ☐ a) 1 થી 9 પાસ
- ☐ b) 10 થી 12 પાસ
- ☐ c) ડિપ્લોમા
- ☐ d) ગ્રૅજ્યૂએટ

6. તમારી વર્તમાન નોકરીની ભૂમિકાઃ-

- ☐ a) કાર્યકર
- ☐ b) સુપરવાઇઝર
- ☐ c) એડમિન

7. વર્ક શિફ્ટનો પ્રકારઃ

- ☐ a) જનરલ
- ☐ b) શિફ્ટ ડ્યુટી
- ☐ c) નાઇટ શિફ્ટ

8. તે શિફ્ટમાં અત્યારે કેટલો સમય થયો છે?

- ☐ a) 1-3 વર્ષ
- ☐ b) 3-5 વર્ષ
- ☐ c) 5 વર્ષથી વધુ

9. છેલ્લા અઠવાડિયે તમારી શિફ્ટ પેટર્નઃ –

શિફ્ટ પ્રકાર	તારીખ	તારીખ	તારીખ	તારીખ	તારીખ	તારીખ	તારીખ
A) જનરલ							
રજા ના દિવસે							
B) સવારની							
રજા ના દિવસે							
C) સાંજની							
રજા ના દિવસે							
D) રાત							
રજા ના દિવસે							

10. કામના કલાકો દરમિયાન શારીરિક પ્રવૃત્તિનું સ્તરઃ-

- ☐ a) મોટાભાગે બેસવું
- ☐ b) મોટે ભાગે ઊભું રહેવું/ચાલવું
- ☐ c) વારંવાર ચાલવું/થોડું ઊંચકવાની સાથે ઊભું રહેવું
- ☐ d) સતત હલનચલન, ભારે ઉઠાંતરી

11. કામના કલાકો દરમિયાન તમે સામાન્ય રીતે તમારું ભોજન ક્યાંથી મેળવો છો?

- ☐ a) ઘરનુ તૈયાર ભોજન
- ☐ b) ઓફિસ કેન્ટીન
- ☐ c) ફૂડ ડિલિવરી સેવાઓ
- ☐ d) નજીકના રેસ્ટોરાં/ખાદ્ય વિક્રેતાઓ

12. તમે કામ પર ઘરેથી કેટલી વાર ભોજન લાવો છો?

- ☐ a) ક્યારેય નહીં
- ☐ b) ક્યારેક
- ☐ c) ઘણીવાર
- ☐ d) હંમેશા

13. શું તમે તમારા વર્ક શિફ્ટના સમયપત્રકના આધારે તમારી ભૂખમાં કોઈ ફેરફાર જોવો છો?

- a) હા, હું રાતની પાળી દરમિયાન વધુ ખાઉં છું
- b) હા, હું રાતની પાળી દરમિયાન ઓછું ખાઉં છું
- c) ના, મારી ભૂખ સ્થિર રહે છે
- d) ખાતરી નથી

14. તમારા કામના સમયપત્રકને કારણે તમે કેટલી વાર ભોજન છોડો છો?

- a) ક્યારેય નહીં
- b) ક્યારેક
- c) ઘણીવાર
- d) હંમેશા

A. Diet Information:

1. તમે:

- a) શાકાહારી
- b) શાકાહારી+ઇંડા
- c) માંસાહારી

2. તમારા માટે દિવસનું સૌથી મહત્વપૂર્ણ ભોજન કયું છે?

- a) સવારનો નાસ્તો
- b) બપોરનું ભોજન
- c) સાંજનો નાસ્તો
- d) રાત્રિભોજન

3. કામની પ્રકૃતિ અનુસાર ભોજનની રીત અને સમયઃ

ભોજન	i) જનરલ શિફ્ટ દરમિયાન ભોજનનો સમય	ii) સવારની શિફ્ટ દરમિયાન ભોજનનો સમય	iii) સાંજની શિફ્ટ દરમિયાન ભોજનનો સમય	iv) રાત્રિ શિફ્ટ દરમિયાન ભોજનનો સમય	v) રજાના દિવસ દરમિયાન ભોજનનો સમય
A) સવારનો નાસ્તો					
B) બપોરનું ભોજન					
C) સાંજે નાસ્તો					
D) રાત્રિભોજન					

તમે તે ભોજન ક્યારે ખાઓ છો તે સમય લખો. ઉદાહરણ તરીકે, તમે તમારી જનરલ શિફ્ટ દરમિયાન સવારે 11 વાગ્યે બપોરનું ભોજન કરો છો, તેથી બપોરના ભોજનના વિકલ્પની સામે સામાન્ય પાળી વિભાગ દરમિયાન ભોજનના સમયે સવારે 11 વાગ્યે લખો. જો તમે કોઇ પણ ભોજન છોડશો તો ના અથવા-લખો.

B. Chronotype & Chrono Profile: Horne & Ostberg Morningness-Eveningness Ques.:

1. જો તમે તમારા દિવસની યોજના બનાવવા માટે તમારી પાસે સમય હોય તો તમે ક્યારે ઉઠશો?	રજા ના દિવસે	
a) 5:00 - 6:30 AM		
b) 6:30 - 7:45 AM		
c) 7:45 - 9:45 AM		
d) 9:45 - 11:00 AM		
e) 11:00 AM - 12:00 PM		

2. જો તમે તમારી સાંજનું આયોજન કરવા માટે સમય હોત તો તમે ક્યારે સૂવાનું પસંદ કરશો ?	રજા ના દિવસે	
a) 8:00 - 9:00 PM		
b) 9:00 - 10:15 PM		
c) 10:15 PM - 12:30 AM		
d) 12:30 - 1:45 AM		
e) 1:45 - 3:00 AM		
3. જો કોઈ ચોક્કસ સમયે તમારે સવારે ઉઠવું હોય, તો તમે અલાર્મ દ્વારા જાગવા પર કેટલો આધાર રાખો છો?		કામના દિવસે
a) ખૂબ જ આશ્રિત		
b) એકદમ આશ્રિત		
c) કેટલેક અંશે આશ્રિત		
d) બિલકુલ આશ્રિત નહીં		
4. તમને સવારે ઉઠવું કેટલું સરળ લાગે છે (જ્યારે તમે અલાર્મથી જાગતા નથી અને કોઈપણ સમયે ઉઠવા માટે સમય છે)?		કામના દિવસે
a) બિલકુલ સરળ નથી		
b) બહુ સરળ નથી		
c) એકદમ સરળ છે		
d) ખૂબ જ સરળ છે		
5. જાગ્યા પછીના પહેલા અડધા કલાક દરમિયાન તમે કેટલું તાજગી અનુભવો છો?	રજા ના દિવસે	કામના દિવસે
a) ખૂબ થાકેલું		
b) એકદમ થાકેલું		
c) એકદમ તાજગીભર્યું		
d) ખૂબ જ તાજગીભર્યું		
6. જાગ્યા પછીના પહેલા અડધા કલાકમાં તમને કેટલી ભૂખ લાગે છે?	રજા ના દિવસે	કામના દિવસે
a) જરા પણ ભુખ નહીં		
b) સહેજ ભુખ		

c) એકદમ ભુખ		
d) ખૂબ ભુખ		
7. સવારે ઉઠ્યાના પહેલા અડધા કલાક દરમિયાન તમને કેટલો થાક લાગે છે?	રજા ના દિવસે	કામના દિવસે
a) ખૂબ થાકેલું		
b) એકદમ થાકેલું		
c) એકદમ તાજગીભર્યું		
d) ખૂબ જ તાજગીભર્યું		
8. જો તમારી પાસે બીજા દિવસે કોઈ પણ પ્રકાર નું કામ ના હોય, તો તમે તમારા સામાન્ય સૂવાના સમયની સરખામણીમાં કેટલા વાગ્યે સૂઈ જશો?	રજા ના દિવસે	કામના દિવસે
a) 8:00 - 9:00 PM		
b) 9:00 - 10:15 PM		
c) 10:15 PM - 12:30 AM		
d) 12:30 - 1:45 AM		
9. તમે થોડી શારીરિક કસરત કરવાનું નક્કી કર્યું છે. એક મિત્ર સૂચવે છે કે તમે અઠવાડિયામાં બે વાર એક કલાક માટે આ કરો અને તમારા માટે શ્રેષ્ઠ સમય સવારે 7 થી 8 વાગ્યાની વચ્ચે છે. તમે તેને સરળતાથી કરી શકશો કે નહીં?	રજા ના દિવસે	
a) એકદમ તાજગીભર્યું		
b) ખૂબ જ તાજગીભર્યું		
c) તેને મુશ્કેલ લાગશે		
d) તેને ખૂબ જ મુશ્કેલ લાગશે		
10. જો તમે ગમે ત્યારે સૂઈ શકો તો તમે લગભગ ક્યારે સૂઈ જશો?		કામના દિવસે
a) 8:00 PM–9:00 PM		
b) 9:00 PM–10:15 PM		
c) 10:15 PM–12:45 AM		
d) 12:45 AM–2:00 AM		

c) 2:00 AM–3:00 AM		
11. તમે તમારા કામ માટે તમારા પ્રથમ રહેવા માંગો છો જે તમે જાણો છો કે માનસિક રીતે કંટાળાજનક હશે અને બે કલાક સુધી ચાલશે. તમે ચાર કાર્યકારી સમયમાંથી કયો સમય પસંદ કરશો? તમે તમારા દિવસનું આયોજન કરવા માટે સંપૂર્ણપણે સ્વતંત્ર છો.		
a) 8 AM–10 AM		
b) 11 AM–1 PM		
c) 3 PM–5 PM		
d) 7 PM–9 PM		
12. જો તમે રાત્રે 11 વાગ્યે સૂઈ જશો, તો તમે કેટલા થાકી જશો?		
a) જરા પણ થાકતો નથી		
b) થોડો થાકેલો છે		
c) એકદમ થાકેલો છે		
d) ખૂબ થાકેલો છે		
13. કેટલાક કારણોસર, તમે સામાન્ય કરતાં ઘણા કલાકો મોડા સૂઈ ગયા છો, પરંતુ બીજા દિવસે સવારે કોઈ ચોક્કસ સમયે ઉઠવાની જરૂર નથી. તમે નીચેનામાંથી કયા સમય ઉઠવાનું પસંદ કરશો ?		
a) તમારા સામાન્ય સમયે જાગો, પરંતુ ઊંઘમાં પાછા ન આવો		
b) તમારા સામાન્ય સમયે જાગો, અને પછી સૂઈ જાઓ		
c) તમારા સામાન્ય સમયે જાગો, પરંતુ ફરીથી સૂઈ જાઓ		
d) સામાન્ય કરતાં મોડા સુધી જાગશો નહીં		
14. એક રાત્રે તમારે તમારું કામ કરવા માટે સવારે 4 થી 6 વાગ્યાની વચ્ચે જાગવું પડે છે અને બીજા દિવસે રજા હોય છે. આમાંથી કયો વિકલ્પ તમને સૌથી વધુ અનુકૂળ રહેશે?		
a) કામ કર્યા પહેલા સુઈ જવું અને કામ કર્યા પછી સુઈ જવુ		
b) કામ ના પહેલા જ સુઈ જવું		
15. તમારી પાસે બે કલાકની સખત શારીરિક મહેનત છે. તમે તમારા દિવસનું આયોજન કરવા માટે સંપૂર્ણપણે સ્વતંત્ર છો. તે કરવા માટે તમે કયો સમય પસંદ કરશો?		
a) 8 AM–10 AM		
b) 11 AM–1 PM		
16. તમે કસરત કરવાનું નક્કી કર્યું છે. એક મિત્ર સૂચવે છે કે તમે 10-11 PM વચ્ચે અઠવાડિયામાં બે વાર એક કલાક માટે આ કરો. તમે તેને સરળતાથી કરી શકશો કે નહીં?		
a) સારા ફોર્મમાં હશે		
b) વાજબી ફોર્મમાં હશે		
c) તેને મુશ્કેલ લાગશે		
d) તેને ખૂબ મુશ્કેલ લાગશે		
17. ધારો કે તમે પાંચ કલાક કામ કરો છો (વિરામ સહિત), તમે આશરે કયા સમયે કામ શરૂ કરવાનું પસંદ કરશો?		

a) સવારે 4 થી 8 વાગ્યા વચ્ચે શરૂ થાય છે		
b) સવારે 8 થી 9 વાગ્યા વચ્ચે શરૂ થાય છે		
c) સવારે 9 થી 2 વાગ્યા વચ્ચે શરૂ થાય છે		
d) બપોરે 2 થી સાંજે 5 વાગ્યાની વચ્ચે શરૂ થાય છે		
e) સાંજે 5 થી 4 વાગ્યા વચ્ચે શરૂ થાય છે		
18. દિવસના કયા સમયે તમને લાગે છે કે આ સમય પર સારુ કામ કરશો?		
a) 5–8 AM		
b) 8–10 AM		
c) 10 AM–5 PM		
d) 5–10 PM		
e) 10 PM–5 AM		
19. શું તમે "મોર્નિંગ ટાઇપ" અથવા "ઇવનિંગ ટાઇપ" છો?		
a) ચોક્કસપણે સવારનો પ્રકાર		
b) સવાર કરતાં સાંજનો પ્રકાર વધુ		
c) ચોક્કસપણે સાંજનો પ્રકાર		

C. કામની વિગતો :

1. છેલ્લા 3 મહિનામાં, એક જે શિફ્ટ મા કામ કર્યુ છે

- ☐ a) હા
- ☐ b) ના

2. સામાન્ય કામનું સમયપત્રક _ _ _ _ _ _ વાગ્યે શરૂ થાય છે... _ _ _ _ _ _ _વાગ્યે સમાપ્ત થાય છે.

3. મારા કામનું સમયપત્રક :

- ☐ a) થોડાક ફેર ફાર થઈ શકે છે
- ☐ b) ફેર ફાર શક્ય નથી
- ☐ c) તેના બદલે અગમ્ય
- ☐ d) ખૂબ જ અગમ્ય છે

4. હું કામ પર જાઉં છું.

- ☐ a) રીક્ષા, બસ, બાઇક દ્વારા
- ☐ b) સાઇકલ ચાલીને
- ☐ c) પગપાળા

5. કામ પર જવા માટે, મને _ _ __ _ _ કલાક અને _ _ __ _ _ મિનિટની જરૂર છે.

6. કામ પરથી મુસાફરી માટે, મને _ _ __ _ _ કલાક અને _ _ __ _ _ મિનિટની જરૂર છે

D. ઉત્તેજક :

	i)દિવસ દીઠ	ii)દર અઠવાડિયે	iii)દર મહિને
A) હું _ _ _ _ _ સિગારેટ પીઉં છું.			
B) હું _ _ _ _ _ કપ કોફી પીઉં છું.			
C) હું _ _ _ _ _ કપ ચા પીઉં છું.			
D) હું કેફીનયુક્ત પીણાં (સોફ્ટ-ડ્રિક્સ) ના _ _ _ _ _ કેન પીઉં છું.			
E) હું ઊંઘની દવા _ _ _ _ _ _ વખત લઉં છું.			

E. Global Physical Activity Questionnaire:

i) શારીરિક પ્રવૃત્તિ	ii) તમારા જવાબને સર્કલ કરો	iii) જો હા, તો પ્રવૃત્તિ પ્રકાર	iv) દિવસ દર અઠવાડિયે	v) દિવસ દીઠ કેટલો સમય (કલાક મિનિટઃ)

A) ઓછામાં ઓછા 10 મિનિટ માટે ભારે વજન ઊંચકવાનું /દોડ/ફૂટબોલ જેવી જોરદાર પ્રવૃત્તિઓ	હા / ના	ભારે ભાર વહન ફૂટબોલ દોડવું વગેરે		
B) ઓછામાં ઓછા 10 મિનિટ માટે ઝડપી ચાલવું અથવા વજન ઊંચકવાનું/ સાયકલિંગ/ સ્વિમિંગ/ વોલીબોલ જેવી મધ્યમ પ્રવૃત્તિઓ	હા / ના	હળવો ભાર ઉપાડવો સાયકલ ચલાવવી તરવું વગેરે -		
C) સ્થળોની મુલાકાત લો	હા / ના	સાયકલ વોક		
D) બેસવું	હા / ના			

F. Perceived Stress Scale Questionnaire:

0-ક્યારેય નહીં, 1-લગભગ ક્યારેય નહીં, 2-ક્યારેક, 3-ઘણી વાર, 4 ઘણી વાર

1) છેલ્લા મહિનામાં, અનપેક્ષિત રીતે બનેલી કોઈ ઘટનાને કારણે તમે કેટલી વાર અસ્વસ્થ થયા છો?	0	1	2	3	4
2) છેલ્લા મહિનામાં, તમને કેટલી વાર લાગ્યું છે કે તમે તમારા જીવનની મહત્વની બાબતોને નિયંત્રિત કરવામાં અસમર્થ છો?	0	1	2	3	4
3) છેલ્લા મહિનામાં, કેટલી વાર તમે નર્વસ અને તણાવ અનુભવ્યો છે?	0	1	2	3	4
4) છેલ્લા મહિનામાં, તમારી વ્યક્તિગત સમસ્યાઓને સંભાળવાની તમારી ક્ષમતા વિશે તમે કેટલી વાર આત્મવિશ્વાસ અનુભવ્યો છે?	0	1	2	3	4
5) છેલ્લા મહિનામાં, તમને કેટલી વાર લાગ્યું છે કે વસ્તુઓ તમારી રીતે ચાલી રહી છે?	0	1	2	3	4

6) છેલ્લા મહિનામાં, તમે કેટલી વાર જોયું છે કે તમારે જે બધી બાબતો કરવાની હતી તેનો તમે સામનો કરી શક્યા નથી? 2) 3)	0	1	2	3	4
7) છેલ્લા મહિનામાં, તમે તમારા જીવનમાં કેટલી વાર લાગ્યું છે કે તમે મુશ્કેલીનો સામનો કર્યો છે નિયંત્રિત કરી શક્યા છો?	0	1	2	3	4
8) છેલ્લા મહિનામાં, તમને કેટલી વાર લાગ્યું છે કે પરિસ્થિતિ નિયંત્રણ મા છે.	0	1	2	3	4
9) છેલ્લા મહિનામાં, તમારા નિયંત્રણ બહારની ઘટનાઓને કારણે તમે કેટલી વાર ગુસ્સે થયા છો?	0	1	2	3	4
10) છેલ્લા મહિનામાં તમને કેટલી વાર લાગ્યું છે કે મુશ્કેલીઓ એટલી વધી રહી છે કે તમે તેને દૂર કરી શક્યા નથી?	0	1	2	3	4

G. Sitting hours:

જોખમની શ્રેણી	બેઠકના કલાકો	તમારા જવાબ પર ટિક કરો
a) ઓછું જોખમ	<4 કલાક/દિવસ	
b) મધ્યમ જોખમ	4-8 કલાક/દિવસ	
c) ઉચ્ચ જોખમ	8-11 કલાક/દિવસ	
d) ખૂબ ઉચ્ચ જોખમ	> 11 કલાક/દિવસ	

H. Pittsburgh Sleep Quality Index:

1) તમે સામાન્ય રીતે કયા સમયે સૂતા હતા?	
>10 વાગ્યે	1
10-10:59 વાગ્યે	2
11-11:59 વાગ્યે	3

12-12:59 વાગ્યે	4
1-1:59 વાગ્યે	5
2-2:59 વાગ્યે	6
<3 વાગ્યે	7

2) પાછલા મહિના દરમિયાન, તમને દરરોજ રાત્રે ઊંઘવામાં કેટલો સમય (મિનિટમાં) લાગ્યો છે?

મિનિટની સંખ્યા _ _ _ _

3) પાછલા મહિના દરમિયાન, તમે સામાન્ય રીતે સવારે ક્યારે ઊઠો છો?

સામાન્ય ઉઠવાનો સમય _ _ _ _ _ _

4) પાછલા મહિના દરમિયાન, તમને રાત્રે કેટલા કલાકની વાસ્તવિક ઊંઘ મળી? (આ તમે પથારીમાં વિતાવેલા કલાકોની સંખ્યા કરતાં અલગ હોઈ શકે છે).
રાત્રે ઊંઘના કલાકો _ _ _ _ _

5) પાછલા મહિના દરમિયાન, તમારા કારણે તમને કેટલી વાર ઊંઘમાં તકલીફ પડી છે.	પાછલા મહિના દરમિયાન નહીં (1)	એક અઠવાડિયાથી ઓછું (2)	અઠવાડિયામાં એક કે બે વાર (3)	અઠવાડિયામાં ત્રણ કે તેથી વધુ વખત (4)	ક્યારેય નહીં (5)
a) 30 મિનિટની અંદર સૂઈ શકાતું નથી					
b) અડધી રાત્રે અથવા વહેલી સવારે ઊઠો					
c) બાથરૂમનો ઉપયોગ કરવા માટે ઊઠી જવું પડે					
d) આરામથી શ્વાસ લઈ શકતો નથી					
e) ઉધરસ અથવા મોટેથી નસકોરાં					
f) ખૂબ ઠંડી લાગે					
g) ગરમી લાગે					
h) ખરાબ સપના આવ્યા					
i) પીડા થાય છે					
j) અન્ય કારણો, કૃપા કરીને વર્ણવો					

k) છેલ્લા મહિના દરમિયાન તમને કેટલી વાર આ કારણે ઊંઘમાં તકલીફ પડી છે?					
6) જો તમારી પાસે રૂમમેટ અથવા બેડ પાર્ટનર હોય, તો તેને પૂછો કે છેલ્લા મહિનામાં તમને કેટલી વાર નસકોરાં થયાં છે.	કોઈ બેડ પાર્ટનર અથવા રૂમમેટ નહીં (1)	બીજા રૂમમાં પાર્ટનર/રૂમમેટ નહીં (2)	એક જ રૂમમાં પાર્ટનર પરંતુ એક જ બેડ નહીં (3)	એક જ બેડમાં પાર્ટનર નહીં (4)	ક્યારેય નહીં (5)
a) મોટેથી નસકોરાં મારવી					
b) ઊંઘતી વખતે શ્વાસ વચ્ચે લાંબો વિરામ					
c) જ્યારે તમે સૂતા હો ત્યારે પગ બદલવા અથવા ઝટકો					
d) ઊંઘ દરમિયાન દિશાહિનતા અથવા મૂંઝવણના પ્રસંગો					

I. Screen Time:

A) અઠવાડિયાના સરેરાશ દિવસે સ્ક્રીનનો ઉપયોગઃ અઠવાડિયાના સરેરાશ દિવસ (જ્યારે તમે જાગો છો ત્યારથી તમે સૂઈ જાઓ છો) વિશે વિચારતા, તમે પ્રાથમિક પ્રવૃત્તિ તરીકે નીચેના દરેક પ્રકારની સ્ક્રીનનો ઉપયોગ કરવામાં કેટલો સમય પસાર કરો છો? તમારે કલાક અને મિનિટ બંનેનો જવાબ આપવો પડશે. જો શૂન્ય હોય તો કૃપા કરીને બૉક્સમાં "0" લખો.			
		કલાકો	મિનિટો
I.	ટેલિવિઝન		
II.	ટીવી-જોડાયેલ ઉપકરણો (દા. ત. સ્ટ્રીમિંગ ઉપકરણો, વિડિયો ગેમ કન્સોલ)		
III.	લેપટોપ/કમ્પ્યુટર		
IV.	સ્માર્ટફોન		
V.	ટેબ્લેટ		

B) અઠવાડિયાની સરેરાશ રાત્રે સ્ક્રીનનો ઉપયોગઃ હવે, અઠવાડિયાની સરેરાશ રાત (જ્યારે તમે કામ પરથી પાછા આવો છો ત્યારથી તમે સૂઈ જાઓ છો) વિશે વિચારીને, તમે પ્રાથમિક પ્રવૃત્તિ તરીકે નીચેના દરેક પ્રકારની સ્ક્રીનનો ઉપયોગ કરવામાં કેટલો સમય પસાર કરો છો? તમારે કલાક અને મિનિટ બંનેનો જવાબ આપવો પડશે. જો શૂન્ય હોય તો કૃપા કરીને બૉક્સમાં "0" લખો.			
		કલાકો	મિનિટો
I.	ટેલિવિઝન		
II.	ટીવી-જોડાયેલ ઉપકરણો (દા. ત. સ્ટ્રીમિંગ ઉપકરણો, વિડિયો ગેમ કન્સોલ)		
III.	લેપટોપ/કમ્પ્યુટર		
IV.	સ્માર્ટફોન		
V.	ટેબ્લેટ		

C) સરેરાશ સમાહાંતના દિવસે સ્ક્રીનનો ઉપયોગ હવે, સરેરાશ સમાહાંતના દિવસ (શનિવાર કે રવિવાર) નો વિચાર કરીને, આખો દિવસ (જ્યારે તમે જાગો છો ત્યારથી તમે સૂઈ જાઓ છો ત્યાં સુધી) કેટલા કલાકનો સમય તમે પ્રાથમિક પ્રવૃત્તિ તરીકે નીચેના દરેક પ્રકારની સ્ક્રીનનો ઉપયોગ કરીને પસાર કરો છો? તમારે કલાક અને મિનિટ બંનેનો જવાબ આપવો પડશે. જો શૂન્ય હોય તો કૃપા કરીને બૉક્સમાં "0" લખો.		
	કલાકો	મિનિટો
I. ટેલિવિઝન		
II. ટીવી-જોડાયેલ ઉપકરણો (દા. ત. સ્ટ્રીમિંગ ઉપકરણો, વિડિયો ગેમ કન્સોલ)		
III. લેપટોપ/કમ્પ્યુટર		
IV. સ્માર્ટફોન		
V. ટેબ્લેટ		

નીચેના પ્રશ્નોના સમૂહ માટે, બેકગ્રાઉન્ડ સ્ક્રીનને કસરત, રસોઇ અને કુટુંબ/મિત્રો સાથે વાતચીત જેવી અન્ય પ્રવૃત્તિઓ કરતી વખતે ટેલિવિઝન અથવા તમારી નજીકની અન્ય સ્ક્રીનના ઉપયોગ તરીકે વ્યાખ્યાયિત કરવામાં આવે છે. અઠવાડિયાના નિયમિત દિવસ (સોમવારથી શુક્રવાર) વિશે વિચારતા, આખા દિવસ દરમિયાન સરેરાશ કેટલા કલાક (જ્યારે તમે જાગો છો ત્યારથી તમે સૂઈ જાઓ છો) તમે પૃષ્ઠભૂમિ સ્ક્રીનના ઉપયોગના સંપર્કમાં છો?

ઉદાહરણ તરીકેઃ જો તમે સવારે ટીવી સમાચાર જોતી વખતે એક કલાક કસરત કરો છો, તો તમે બપોરનું ભોજન કરતી વખતે એક કલાક માટે તમારા સ્માર્ટફોનનો ઉપયોગ કરો છો અને રાત્રિભોજન કરતી વખતે વધારાની 30 મિનિટનો ઉપયોગ કરો છો, તો તમે અંદાજ લગાવશો કે તમે દરરોજ 2 કલાક અને 30 મિનિટ બેકગ્રાઉન્ડ સ્ક્રીનનો ઉપયોગ કરો છો.

	કલાકો	મિનિટો
D) નિયમિત અઠવાડિયાના દિવસે પૃષ્ઠભૂમિ સ્ક્રીનનો ઉપયોગ કરો.		
E) અઠવાડિયાની નિયમિત રાત્રે બેકગ્રાઉન્ડ સ્ક્રીનનો ઉપયોગ કરો.		
F) નિયમિત સપ્તાહના દિવસે બેકગ્રાઉન્ડ સ્ક્રીનનો ઉપયોગ કરો.		

ONLY FOR ROTATIONAL SHIFT WORKERS

J. Munich Chronotype Questionnaire for Rotational Shift Workers: -

નીચેના પ્રશ્નો કામના દિવસો અને ખાલી દિવસોમાં તમારી ઊંઘ અને જાગવાની વર્તણૂક સાથે સંબંધિત છે. મહેરબાની કરીને તેમને તમારા વર્તમાન પાળીના સમયપત્રક વિશે જવાબ આપો, એટલે કે તમામ સંયોજનો ભરવાની જરૂર નથી!

ઉપરાંત, કૃપા કરીને વર્તમાન સીઝન (એટલે કે છેલ્લા 6 અઠવાડિયા) ના સંદર્ભમાં જવાબ આપો. જ્યારે જવાબ મુશ્કેલ લાગે ત્યારે પણ કૃપા કરીને બધા પ્રશ્નોના જવાબ આપવાનો પ્રયાસ કરો! સ્વયંસ્ફુરિત જવાબો ઘણીવાર શ્રેષ્ઠ હોય છે.

મહેરબાની કરીને સ્પષ્ટ સમય સંદર્ભો પ્રદાન કરીને તમારા ડેટાના મૂલ્યાંકનમાં અમારી મદદ કરો. (ઉદાહરણ તરીકે. 11:00
PM ને બદલે 23:00).

કામનો સ્વભાવ	તમે જે સમયે સૂતા હો તે સમય	આ સમય જ્યારે તમે ઊંઘવા માટે તૈયાર છો	ઊંઘ આવામા લાગતો સમય	ઉઠવાનો સમય	ઊઠવામા લાગતો સમય	શુ તમે એલાર્મ વાગવાથી જાગી જાઓ છો	હા/ ના	જો હા, સમય લખો	તો શું તમે તમારી ઊંઘનો સમય પસંદ કરી શકો છો	જો હા હોય, તો તેનું કારણ શું છે?
સામાન્ય						હા / ના	હા / ના		હા / ના	બાળકો શોખ અન્ય
મોર્નિંગ						હા / ના	હા / ના		હા / ના	બાળકો શોખ અન્ય
ઇવનિંગ						હા / ના	હા / ના		હા / ના	બાળકો શોખ અન્ય
નાઇટ						હા / ના	હા / ના		હા / ના	બાળકો શોખ અન્ય
ઑફ ડે						હા / ના	હા / ના		હા / ના	બાળકો શોખ અન્ય