IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
MASTER OF AIR TRANSPORT MANAGEMENT

MASTER THESIS

EXAMINING THE CAUSES AND EFFECTS OF FLIGHT ATTENDANT FATIGUE

GÖZDE ERBUDAK

THESIS SUPERVISOR

PROF. MUSTAFA KEMAL YILMAZ

ISTANBUL, 2022

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EXAMINING THE CAUSES AND EFFECTS OF FLIGHT ATTENDANT FATIGUE

by

GÖZDE ERBUDAK

A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Science in Air Transport Management

THESIS SUPERVISOR

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ISTANBUL, 2022

APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Air Transport Management.

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This is to confirm that this thesis complies with all the standards set by the School of Graduate Studies of Ibn Haldun University

Date of Submission Seal/Signature

ACADEMIC HONESTY ATTESTATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ÖZ

KABİN MEMURLARINDA YAŞANAN BİTKİNLİĞİN SEBEPLERİ VE ETKİLERİ

Erbudak, Gözde
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Tez Danışmanı: Prof. Dr. Mustafa Kemal Yılmaz
Ocak 2022, 87 sayfa

Son yıllarda sivil havacılık faaliyetlerinin kapsamı hızla artmış olup bu büyüme beraberinde kabin memurlarına yönelik beklentileri de yükseltmiştir. Kabin ekipleri görevlerinin farklılaşmasıyla birlikte, uzun mesaili görevler, ardışık çalışma günleri, ağır iş yükü gibi çeşitli zorluklar ile karşı karşıya kalmaktadırlar. Bundan dolayı; düzensiz uyku, yetersiz dinlenme süresi, uzun çalışma süresi gibi faktörler kabin memurlarını fiziksel ve zihinsel bitkinliğe maruz bırakmaktadır. Bu çalışma, büyük bir Türk havayolu şirketinde çalışan kabin memurlarında yaşanan bitkinliğin sebeplerini ve etkilerini anket yöntemi aracılığıyla araştırmaktadır. Geliştirilen anket çevrimiçi olarak 152 kabin memuruna uygulanmıştır. Anket ile demografik özellikler, uyku kalitesi, bitkinlik deneyimi, bitkinliğin sebepleri ve etkileri ile bitkinliği yönetme stratejileri hakkında veri toplanmıştır. Verilerin işlenmesi ile elde edilen sonuçlar, neredeyse tüm katılımcıların uykuya ilişkin problemler yaşadığını göstermektedir. Bulgular, kabin memurlarının çoğunun uçuş görevinden önce uykuya dalmakta zorlandıklarına işaret etmektedir. Gece uçuşları öncesinde ve minimum dinlenme süreli yatılardaki uyku sürelerinin de oldukça düşük olduğu görülmektedir. Buna ek olarak, önemli sayıda kabin memuru uçuş esnasında istemsizce uyuya kalmaktadır. Ayrıca sonuçlar, minimum dinlenme süreli yatılar, gece uçuşları, ardışık çalışma günleri ve dört bacak uçuş görevi gibi planlamaya ilişkin faktörlerin bitkinliğe yol açmada önemli rol oynadığını ortaya koymaktadır. Bu hususlardan dolayı,

planlamanın iyileştirilmesi gerekmektedir. İş ve sosyal yaşam arasında denge kurmak konusunda erkekler kadınlardan daha fazla zorlanmakta, evliler ise bekârlara göre daha fazla zorluk yaşamaktadır. Diğer yandan, genç kabin memurlarının gece uçuşu öncesi uyku süreleri yaşça büyük olan meslektaşlarına göre çarpıcı derecede düşüktür. Kabin memurlarının çoğunun bağışıklık sistemi çalışma koşullarından negatif etkilenmektedir. Bu araştırmanın sonuçları havayolu şirketleri ve politika yapıcılar için, havayolu operasyonlarının güvenliğini ve kabin memurlarının sağlık ve mutluluğunu sağlamak için bitkinlik ile ilgili faktörleri etkin bir şekilde yönetebilmeleri konusunda değerli bilgiler sunmaktadır.

Anahtar Kelimeler: Bitkinlik, Havayolu şirketleri, Kabin Ekibi, Kabin Memuru, Türkiye

ABSTRACT

EXAMINING THE CAUSES AND EFFECTS OF FLIGHT ATTENDANT FATIGUE

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The scope of civil aviation operations has increased rapidly in recent years. This growth has also raised the expectations from flight attendants. The duties of cabin crews have diversified and created several challenges including longer duty days, consecutive working days, heavy workload. Hence, flight attendants have become subject to physical and mental fatigue due to irregular sleep, inadequate rest time, and long working hours. This study investigates the causes and effects of fatigue among flight attendants of a Turkish airline company through a self-administrated questionnaire. A structured survey was developed and run online to 152 flight attendants. It collected data on demographics, sleep quality, fatigue experience, causes and effects of fatigue, and fatigue management strategies. The results show that almost all participants experience sleep-related issues. The findings indicate that the majority of the flight attendants have trouble falling asleep before flight duty. The sleep duration before night flights and during layovers with minimum rest time is dramatically low. Moreover, a significant number of flight attendants have admitted having nodded-off unwillingly during flight. The results also reveal that factors related to scheduling - i.e., layovers with minimum rest time, long duty days, night flights, consecutive working days and 4-legged flight duty play an important role in causing fatigue. Hence, scheduling should be improved. In balancing work and social life, men struggle more than women and married flight attendants have more difficulty than single ones.

Also, the sleep duration before night flights is strikingly low in younger cabin crews than their older colleagues. The immune system of the majority of the flight attendants is negatively affected due to working conditions. These findings provide valuable insights for airline companies and policymakers to seriously manage fatigue related factors to ensure the security and safety of airline operations and the well-being of flight attendants.

Keywords: Airline companies, Cabin crew, Fatigue, Flight attendant, Turkey

DEDICATION

This dissertation is dedicated to my husband, İlkim Erbudak, who has been a source of strength, support, and motivation for me throughout this entire process.

I also dedicate this work to all my friends who are currently employed as flight attendants. I appreciate the hard work and effort they put into their job.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Prof. Dr. Mustafa Kemal Yılmaz for his enthusiasm, consistent support, guidance, and recommendations on this dissertation. I also thank to Sema Gündüz for her valuable support and guidance in data analysis and methodology part of this study.

Finally, I would like to extend my deepest gratitude to all flight attendants who participated to this research survey. They contribute to complete my research.

Gözde Erbudak

ISTANBUL, 2022

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LIST OF SYMBOLS AND ABBREVIATIONS

5M	Human-Machine-Environment-Mission-Management Model
ANOVA	Analysis of Variance
CAA	Civil Aviation Authorities
CAMI	Civil Aerospace Medical Institute
CBA	Collective Bargaining Agreements
CPR	Cardiopulmonary Resuscitation
CRM	Crew Resource Management
Df	Degrees of Freedom
ER	Extended Range
FA	Flight Attendant
FAA	Federal Aviation Administration
FDP	Flight Duty Time
FTL	Flight Time Limits
ICAO	International Civil Aviation Organization
NASA	National Aeronautics and Space Administration
NTSB	National Transportation Safety Board
SPSS	Statistical Package for the Social Sciences
US	United States
WAI	Work Ability Index

CHAPTER I

INTRODUCTION

1.1. Motivation of the Study

The aviation industry significantly contributes to economic and social developments on a regional, national, and international scale. It also supports other industries by creating new business and job opportunities. Civil aviation relies on 24-hours flight operations. This dynamic nature of the airline industry has created challenges to cabin crews more than ever before. Irregular working hours and schedules, frequent time zone changes have increased the level and prevalence of fatigue among cabin crews. Some of these challenges have made the life of flight attendants more difficult due to occupational health risks (McNeely et al., 2014). Nowadays, the job of flight attendants requires longer flight hours with quicker turnarounds between flights, circumpolar navigational routes, high percentage of passenger loads in wide-body aircrafts, increased occupancy for international flights and new security procedures. Thus, new trends in aviation industry have raised occupational risks of flight attendants and fatigue is one of them.

A global macro-economic downturn and increased price pressure from low-cost airlines have also led many full-service airlines to find ways to reduce their costs. For instance, the minimum layover period has been decreased from 44 hours to 24 hours in the US Federal Aviation Administration's Flight Attendant Duty Time and Rest regulations. They have also changed the "reduced rest" provision from nine hours to eight hours, and the number of cabin crews required for each flight has been reduced. These changes have affected cabin crews through high levels of fatigue, inefficient service delivery and low morale since many airlines oblige flight attendants to stay more productive with irregular schedules (Imm Ng et al., 2011). Thus, cabin crews are

required to work long duty days, and flagrant violations of schedules creates high levels of tiredness (Brown & Niehaus, 2009).

International Civil Aviation Organization (ICAO) defines fatigue as *"*a physiological state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, circadian phase, and/or workload (mental and/or physical activity) that can impair a person's alertness and ability to perform safety related operational duties.*"* (ICAO, 2016). Aviation is one of the fields where concerns about fatigue are on rise. In this context, fatigue experienced by cabin crews pose a threat to occupational health, safety, and performance.

National Transportation Safety Board (NTSB) has admitted the hazard caused by fatigue in the transportation industry and has suggested to put limits for working hours for transportation operators based on fatigue research. The subjects of the fatigue research were a group of employees with serious concern like air traffic controllers, pilots, and maintenance staff. The results show that the aviation industry should be aware of the serious concerns that stemmed from cabin crew fatigue, particularly in security awareness (Lauria et al., 2006).

Flight attendants perform several tasks. Although they should primarily take care of the needs of passengers, they also perform a pre-flight safety demonstration in the cabin. Before take-off and landing, they must give a cabin ready report to the cockpit. Cabin ready means that galleys are secured, all passengers are seated at upright position with their seatbelts on, window blinds are open, and all hand luggage are stored safely. Additionally, they periodically check flight crew to confirm their health and safety. They also inform pilots if there are any unusual noises or smells in the cabin. Moreover, flight attendants handle emergency situations such as evacuating passengers out of the aircraft, giving instructions for using rafts and slides, in-flight firefighting, providing first aid and cardiopulmonary resuscitation (CPR), defibrillating passengers, adhering to emergency landing procedures, and handling emergency decompression situations. They ensure cabin and passenger safety during turbulence.

The fatigue of flight attendants has become an important issue that needs to be addressed because it threatens the ability of flight attendants to perform their safety and security duties. As Nesthus et al. (2007) claimed that fatigue can cause flight attendants to forget doing significant safety and security duties like disarming or engaging emergency exit doors, informing passengers about safety procedures such as to check everyone's seat belts before take-off or not stowing hand luggage or service items properly. Fatigue may also have detrimental effects on alertness level in responding to an emergency case. Although there is a downward trend in the number of accidents in aviation industry, accidents rates that are tied to human factors have been on rise. In this sense, fatigue has become a prevalent factor that impairs the performance of flight attendants.

1.2. International Regulations

Since fatigue exposes a critical threat both to safety-related performance and health of occupational employees like cabin crews, some prescriptive rules are introduced to manage fatigue. Although a certain level of fatigue is controlled by international prescriptive rules, these rules only comprise maximum hours of work and minimum hours of rest (Banks et al., 2009). However, besides these rules, there are other significant factors that affect the level of fatigue. As Cabon (2009) stated current international prescriptive rules about fatigue management do not consider 24 hours operations, crossing multiple time zones, layover and recovery time, and circadian rhythms. Even though civil aviation regulations and rules may differ from one country to another, their base still relies on international fatigue management practices. Therefore, different regulations and international rules regarding flight attendant fatigue will be explored in Chapter 2.

1.3. Contribution to the Literature

Fatigue experienced by cabin crews is an alarming issue for civil aviation operations. Changes in aviation industry have made this issue more important for safety. Rosekind et al. (1996) proved that fatigue causes poor decision making, impairment in performance, slower reaction time, reduced levels of alertness, and poor communication skills. It is important to note that many interrelated factors may cause

fatigue. In this sense, underlying factors that cause fatigue should be analysed in a comprehensive way to provide a deep knowledge and awareness for policy makers and airline companies to implement better countermeasures to mitigate the effects of fatigue experienced by flight attendants.

This study aims to make significant contributions to the literature by its comprehensive approach to fatigue from the side of flight attendants. In this context, this research will explore potential causes and effects of fatigue and will make suggestions to reduce the occurrence of fatigue among flight attendants. In this frame, the present study provides valuable insights to policy makers and regulatory authorities to take new measures to deal with fatigue and airline companies to insert new policies to manage that problem.

1.4. The Structure of the Thesis

In the literature, studies that rely on the direct experience of flight attendants through questionnaires, surveys or focus group discussions usually produce more measurable results (e.g., Avers et al., 2019; Banks et al., 2012; Chung et al., 2009; Ono et al., 1991; Van Den Berg et al. 2019). The primary aim of this study is to analyse the causes and effects of fatigue among flight attendants through self-administrated questionnaire that is specifically designed for flight attendants. Second, this study intends to provide insights and recommendations to airline companies and policy makers. It is expected that airline companies will have an opportunity to manage fatigue related risks better in the future and cabin crews can have a vision to manage fatigue related factors better with increased awareness. In this frame, the survey used in this study focuses on eight subjects, namely personnel demographics, sleep quality, fatigue experience, causes and effects of fatigue, strategies to minimize its effects, recommendations, and fatigue training programs. The survey is applied to a sample of 152 cabin crew members of a Turkish airline company.

This thesis is organized into six chapters:

Chapter I makes a short introduction and gives a general outlook on the motivation of the study and research questions.

Chapter II explains relevant concepts of the topic of interest in civil aviation and provides information on the international regulations applicable on fatigue in aviation. Chapter III provides the literature review by discussing theoretical and conceptual background and develops the hypotheses.

Chapter IV focuses on data collection, and research methodology employed in the study.

Chapter V provides the findings of the research and discusses the results.

Chapter VI concludes the study and discusses implications along with the limitations and suggestions for future research.

CHAPTER II

HUMAN FACTORS AND FATIGUE IN AVIATION INDUSTRY

Fatigue is an inevitable issue in aviation industry. It is usually managed by international prescriptive rules. However, the scope of these prescriptive rules is mostly related to the maximum number of work hours and minimum time of rest and does not cover other factors that may significantly contribute to the level of fatigue. Some of these factors include round-the-clock operations, circadian rhythm disruptions, time of the flights in a day, and time zone differences.

Civil Aerospace Medical Institute (CAMI) contracted with National Aeronautics and Space Administration (NASA) Ames Research Center's Fatigue Countermeasures Group and generated a report about flight attendant fatigue in 2005. In this report, CAMI and NASA examined the incident report reviews and analysed a wide range of typical cabin crew schedules to determine possible vulnerability of fatigue (Banks et al., 2009). Federal Aviation Administration (FAA) Office of Aerospace Medicine Technical Report published two reports that were delivered by NASA (Nesthus et al., 2007). In these reports, NASA recommended six research areas that would improve government-industry decision making on fatigue. These areas include; a survey about field operations, field research on the effects of fatigue, a validation of models that assess flight attendant fatigue, a focused study on incident reports, a review of international practices and policies, and the potential benefits of training.

In 2008, US Congress directed CAMI to assert another directive to follow up the studies on these six areas. To develop this directive, CAMI presented a project plan for each recommendation. To increase support and participation to the project, CAMI got in touch with the representatives of authorized organizations, including Association of Professional Flight Attendants, Coalition of Flight Attendants

Association, Air Transport Association, Transportation Workers Unions, Regional Airline Association, International Association Machinists, Delta Airlines, United Steel Workers, and non-unionized airlines (Banks et al., 2009).

Banks et al. (2009) researched each regulation and Collective Bargaining Agreements (CBAs) and created a list of duty time and rest rules to manage fatigue. The most commonly used rules can be summarized as follows: flight and duty time period, flight time limitation period, minimum and reduced rest period, compensatory rest, crew rest facilities, day-off, on duty rest break, late finished or early starts, positioning/ deadheading, standby/reserve duty, time-zone adjustment, duration of prone sleep (rest), fatigue responsibility, discretion of commander/captain, long-rage flights, and crew complement. According to the suggestions of NTSB, each rule was categorized into 4 sections: working hour limits, sleep and rest requirements, circadian rhythms, and others.

2.1. A General Outlook to the Aviation Industry

Transportation is a service that enables people and goods to move from one point to another. Air transport allows the movement of people, cargo, and mail from the air by an aircraft with space and time benefits. All civil aviation activities including design, production, maintenance, airport, ground handling, navigation, communication, and air traffic should be carried out safely, securely, and effectively (Gerede, 2011). Civil aviation authorities are expected to design regulations to meet these goals and to supervise compliance with the regulations.

Since the Second World War, air transport has become one of the most important and innovative industries in the world, bringing economic and social progress to nations. It has stimulated employment and prosperity to millions of people while it has expanded international trade to a great extent, increasing opportunities for travel and tourism. The industry meets the growing needs of its customers in a sustainable way, while it maintains a balance between economic progress, social development, and environmental responsibility. This means balancing the needs of passengers, society, economy, and environment, and making the best use of existing facilities (Addipally et al., 2018). Air transport has had less impact on environment than many people think.

By continuously improving fuel efficiency, reducing noise, and introducing new and more sustainable technologies, air transport industry has been able to reduce its environmental impact.

Aviation industry has two sub-divisions: civil aviation and general aviation. Civil aviation covers all non-military flights, including both general aviation and scheduled air transport, while general aviation includes all kinds of non-military flights, except for a certain scheduled air transport, and covers a wide area from a flight with a sail wing to an unscheduled cargo transport with a Boeing 747. This separation changes the scope of regulations on air transport businesses. Therefore, it is useful to indicate the differences between these two types of transportation. The following part explains these differences (Flores & Ferrer, 2017):

- *Profit purpose:* In air transport, the profitability is the main goal. However, in general aviation, both profit-oriented and non-profit transport are the case.
- *Function:* In air transport, the benefit of rapid relocation is provided during the transportation. However, in the transportation process within the scope of general aviation, side functions such as flight training, photographing, spraying, insemination, weather forecast, firefighting, border, pipe, and energy lines are also performed.
- *Aircraft used:* In airline transport, relatively larger, faster, and fixed-wing aircrafts with higher maximum take-off weight, carrying capacity and range are used. However, in general aviation, a wide range of aircraft from balloon, paragliding, delta wing, micro-light and helicopters to micro jets are used.
- *Public openness:* Relatively more people and freight are transported in air transport. The public transport is open to everyone, provided that, they pay the fee. However, in general aviation, relatively few people and loads are transported. As in-flight training activities, not everyone can benefit from this service.
- *Scale:* Although there are short-distance flights in air transportation, the area served is generally larger and wider than general aviation transportation. Since the production capacities of the aircraft used are large, both the area covered, and the production scale is larger.

Nowadays, the competition in air transport industry is increasingly focused on airline product (Yi & Yoo, 2018). Hence, the components of the airline product offered by airline companies and their features heavily influence demand and revenues generated by airline business. The characteristics of the product also affect operating costs of airline companies (Niewiadomski, 2017). Thus, one of the most fundamental questions in airline management is how to increase revenues and reduce costs. Therefore, effectively designing the airline product is extremely important.

Human beings are at the heart of aviation activities. Sometimes the service quality in airline transportation is evaluated only with in-cabin services. In other words, it is assumed that the airline product consists of only the services provided by cabin crew. In fact, airline service is usually offered in bulk. There is no special offer for a single person. Meeting the demands of customers plays a vital role in increasing service quality, revenue, and customer loyalty (Wali & Nwokah, 2017).

2.2. Human Factors in Aviation Industry

The rate of human error in aviation accidents ranges between 70% and 80% (Shappell et al., 2017). Therefore, the role of human factors in accidents should be understood to reduce accidents in aviation and to increase flight safety (Shappell et al., 2017). The reports on aircraft accidents and incidents reveal that inadequate communication and disruptions in teamwork has a significant impact on human errors. Thus, team management is an important field in aviation. This includes the interactions among people, the teamwork inputs, processes, and final outputs.

For cabin crews, inner work environment includes physical factors i.e., temperature, light, noise, vibration, and air quality, while external environment includes factors such as weather conditions, aviation infrastructure and obstacles. The interaction between inner environment and outer environment is covered in this area. Psychological and physiological difficulties such as illness, fatigue, financial difficulties, concerns about relationships and career development are also issues of human-environment interaction. Aviation is an area where normal biological rhythms and sleep patterns can be disrupted. Moreover, organizational problems that affect

decision-making processes and that create pressure also cause breaches of rules and procedures (ICAO, 2013).

2.3. Modelling Human Factors in Aviation

To survive, all individuals in aviation must be fully prepared for their duties. This includes not only knowing weather conditions, aerodynamics, power and propulsion, navigation, but also being flexible, reliable, and easily adaptable (Griffin et al., 2017). Thus, human factor is one of the most valuable attributes that affect the performance of the aviation system. Some models aim to prevent human-related errors in accidents by considering the activities of cockpit, cabin crew and technical team as "human factors" (Erdemli, 2011). The following part explains the characteristics of Shell Model and Human-Machine-Environment-Mission-Management (5M) Model.

i. Shell Model

Although Shell Model reveals the relationship between human factors and performance at a conceptual level, it is a simple expression of a very complex situation. The model examines the interaction of all components. “Flight Crew Resource Management” is an application area of the human factors discipline to the aviation field, and it is based on the integration of human-machine and human-human interaction, all individuals within the scope of flight operation. While two or three people interact directly in an airplane cockpit, cabin attendants, air traffic controllers, ground handling personnel and other personnel are also involved in this interaction (Dumitru & Boşcoianu, 2015).

ii. Human-Machine-Environment-Mission-Management (5M) Model

The flight crew resource management approach is an application of both human-human and human-machine interaction in the cockpit. Human-machine interaction with the flight crew usually consists of one or more components. Components such as aircraft maintenance, ground services, meteorologists, air, and ground traffic controllers come together in the cockpit to serve a common purpose. For a successful flight operation, all these components must work in coordination (Ahsan et al., 2018).

2.4. Flight Attendant and Resource Management Attitudes

Before examining flight crew resource management attitudes, it would be useful to define the concept of attitude. Attitude is a tendency that is attributed to an individual and regularly forms his thoughts, feelings, and behaviours about a psychological object (Jensen, 2017). Attitude is not a behaviour that can be observed and manifested, but a preparatory tendency for behaviour. Flight crew resource management attitudes are one of the most important inputs that guide the behaviour of pilots in the cockpit and determine the performance of flight crew (Dumitru & Boşcoianu, 2015).

The attitudes of flight crew in terms of interpersonal behavioural differences, especially under risky situations, may be explained by personality traits such as how dominant-abstaining, how determinedly indecisive, how easily anxious, how submissive-struggling and how dependent-independent they are. The effectiveness of crew resource management depends on two factors (Ji et al., 2019). The first factor is the personality of individuals that make up the flight crew and the second one is the appropriate attitudes of individuals. The relationship between these two factors and their contribution to flight performance are important in terms of determining strategies to improve cockpit management. "Personality" and "personality traits" are structures that are acquired during the development of the individual and are relatively permanent characteristics and are resistant to change. The first dimension within the scope of flight crew resource management is the "communication, coordination and teamwork" dimension. It includes communication regarding flight intent and planning, delegation of duties and determination of responsibilities, and monitoring of flight crew members. The second dimension, "command or cockpit management responsibility", is the concept of leadership for cockpit management and it is applicable to the delegation of duties and determination of responsibilities. The third dimension is “identification of stressor effects”. It includes stress, fatigue, and under emergency conditions. The following part describes these dimensions.

i. Attitudes Towards Communication, Coordination, and Teamwork

Pilots should be effective in communication and coordination to achieve high performance in a successful flight (Ji et al., 2019). Communication is an essential process of teamwork for both flight safety and cabin crews. The use of clear language

is at the focal point in this process. Adequate communication requires individuals to understand, and act in line with the data received. For individuals to understand their responsibilities, clearly written and easily understandable directives, instructions, and handbooks (aircraft manuals, standard operating procedures) are required.

Communication and coordination are the main factor of many successful flights and accidents in aviation. Resource management is expected to provide efficient coordination and use of resources such as optimal combination of knowledge, judgment, and decision-making skills of flight crews inside and outside the aircraft, both material and human (Lester et al., 2017). Flight crews that communicate more during the flight tend to show higher performance (Dumitru & Boşcoianu, 2015).

ii. Cockpit Management Attitudes

Captain pilots usually bear the responsibility of the aircraft. However, this responsibility is still shared between captain and co-pilot. Therefore, the attitude of captain pilots and co-pilots in the cockpit is one of the fundamental factors of flight performance as well as flight safety. A malfunction in the cockpit management or inability to manage a possible emergency has been recorded as the cause of many accidents (Peksatıcı, 2018).

iii. Attitudes Regarding Physical Performance Under Stress, Fatigue, And Emergency

The situations caused by fatigue and emergency conditions are also important. In aviation, fatigue occurs due to insufficient rest, intense cognitive activity, increased physical workload or physiological rhythm disturbance (Dykstra & Paul, 2018). The willingness of flight crew members to accept both their own stress and fatigue and the stress and fatigue of other crew members, their awareness levels, and their ability to compensate for reduced capacity in a possible emergency are considered in this dimension (Taber, 2020). Stress factors are the ones that create physiological and psychological pressure on the individual and make it difficult for them to react physically, and emotionally. Chronic stress negatively affects flight performance and decision-making. The cumulative result of these stresses is fatigue.

The most important factors that affect flight crew performance are the working environment derived by stress and fatigue conditions. Stress is defined as a negative

emotional arousal state such as fear, anxiety, anger, and hostility that threatens both individual performance and team performance, rapidly disrupting emotional climate. Conflicts arising from workload and variable duty times, delays arising from air traffic and meteorological conditions, problems between employees and management are known as business stresses that have become traditional in civil aviation.

Another factor affecting flight performance is fatigue. Fatigue can potentially cause unsafe situations and poor productivity (Papanikou et al., 2020). It can be defined as a condition caused by an impaired biorhythm as well as a condition caused by incomplete rest. Excessive fatigue is caused by long-term tasks or tasks that are required to be accomplished in a short time, while chronic fatigue is caused by the additional factors that cause fatigue over a long period of time. In mental fatigue, emotional stress is present even when resting is normal.

2.5. International Regulations in Aviation

Pilots often operate in a difficult and stress-intensive environment. Flight attendants are also tired of complex mission schedules that take long hours, just like passengers. Jet lag is a lifestyle for flight crews that cannot find enough rest within the flight programs that include day and night changes and different time zones. Thus, flight regulations in aviation are important in managing all these issues. The following sections explain different regulations initiated on improving these problems.

2.5.1. Working Hour Limitations

Not all airlines use flight time limits (FTL) in the schedules of flight attendants. 31% of CBAs and just over half of the regulations limit the work hours of flight attendants within a month. However, among the airlines that use FTL, there is a remarkable variability within a month –depending on airline or Civil Aviation Authorities (CAA)- ranging from 85 to 210 hours and 28 or 30 consecutive days. Moreover, 45% of the regulations and 75% of CBAs that adopt FTL to flight attendant schedules apply 100 hours flight time restriction within a month. Some of the regulations that use 100 hours limits suggest that flights must be scheduled evenly within 28 or 30 consecutive days to prevent high work hours for short-time periods.

ICAO Regulation Annex 6, Part I states that the operator must apply flight and duty time restrictions and rest requirement scheduling that minimize fatigue for its aircrew members (ICAO, 2013). Flight duty time (FDP) is one of the significant factors that contribute to the fatigue. Similar to working hour limits, FDP varies from operator to operator. Moebus (2008) suggested that FDP for a day should never be more than 13 hours within specific conditions and claimed that FDP that exceeds 13 hours is inconsistent with current studies. In this context, NTSB suggested that flight and duty time limits and rest requirements should have scientific standards for all airlines.

Nesthus et al. (2009) argued that the length of duty is one of the prevalent factors that increase flight attendant fatigue. However, the rules on the length of duty vary across airlines. As FAA's Flight Attendant Fatigue, Part V report (2009) suggested, many operators still adopt the same duty time and rest rules for their flight and cabin crews. However, their duties are different and the same FDP limits cannot be applied to all aircrew members. As mentioned above, operators have different scheduling practices, and some airlines schedule the same reporting time for pilots and flight attendants. However, in terms of length of duty, flight attendants must do pre-flight briefing and pre-flight preparation, thus, their duty usually begins one hour earlier than flight crew. Therefore, some of the factors that contribute to fatigue like length of duty should be separated for flight and cabin crews, and all operators should have distinct rules for each aircrew member (Salgirli et al., 2012).

Standby rules could also be one of the factors that significantly contribute to flight attendant fatigue. Different standby duties (i.e., standby at home, in the airport or in a hotel) have different equivalents for length of duty and can be considered as half or full time working. Banks et al. (2009) found that some operators have regulations of maximum hour limits for standby duty and require accommodation facilities needed for convenient rest during standby. Nevertheless, majority of the regulations and CBAs (66% of the regulations and 69% of CBAs) do not have rules for maximum hours of work during standby duty. Only 29% of regulations and 7% of CBAs have provisions regarding rest time during standby duty.

Among the operators that have provisions for standby duty (34% of regulations and 31% CBAs) the maximum work hour is set to 12 hours (Banks et al., 2009). Although

standby duty does not include flight duties, individuals still spend time and energy for the job. For instance, if a flight attendant has a standby duty in the airport, he must be prepared as there is a flight duty with layover. Since he can be appointed to a flight duty in a country with different season, he should prepare his baggage with clothes that is suitable to every season. If it is a night standby duty, he should be awake all night and this leads to sleep deprivation and circadian rhythm disruption. Fatigue is usually high during wakefulness whether the flight attendant is performing tasks with heavy workload or is idle (Åkerstedt et al., 2004; Hancock & Verwey, 1997). Therefore, standby duty should be counted within the length of duty, and operators should have legal policies on the maximum hours of work. Moreover, there is a need for international prescriptive rules to incorporate standby rules to be counted as full time working for all operators.

2.5.2. Sleep and Rest Requirements

Not only the timing of rest period but also the duration of it is critical for proper fatigue management. In that sense, minimum rest period requirements should be regulated in a way that it minimizes the fatigue of cabin crews. Avers et al. (2009) stated that according to National Duty, Rest, and Fatigue Survey, individuals should get 7 to 9 hours of sleep during the night. In addition, for flight attendants, the scheduled rest period should start after arriving the rest facility. For instance, the minimum 9 hours of rest period for the US flight attendants is inadequate for sufficient rest. The US cabin crews spend 16 minutes for transportation, and it takes them 49 minutes to arrive the rest facility on average. Given this fact, within the 9 hours of minimum time, there is less than 8 hours for other personal needs such as sleep, personal hygiene, eating, check-in and so forth (Banks et al, 2009). However, 26% of the international regulations and 7% of the agreements had provisions to allow airlines to prescribe additional time for rest. The US National Sleep Foundation suggests that adults should get 7 to 9 hours of sleep on average. Cumulative sleep deficit occurs for a person that gets sleep less than the recommended hours. Thus, he is more likely to experience impaired brain function and cognitive performance. Flight and cabin crews whose flight hours tend to be irregular belong to risky occupational groups in terms of fatigue. Therefore, cumulative fatigue occurs if flight attendants fly consecutive days with

minimum rest period (Piegon et al., 2010). This issue has become more critical when operators adopt provisions that reduce minimum rest period.

2.5.3. Increasing Working Hours

In the last decades, the number of flights around the world have been almost doubled. Most of the airlines have increased their budget, created new flights to new places, and hired new employees (Boyce & Ndikumana, 2012). In recent years, the number of long nonstop flights has also risen significantly along with the passenger load. With the advancement of administrative control over working hours, total monthly flight hours are also increasing and approaching the limits established by labor management agreements. Although the number of passengers has increased, the number of flight attendants has not kept pace. Thus, an ideal work-rest balance is necessary to preserve good health or to avoid fatigue symptoms from worsening (Ono et al., 1991). Many job-related factors have contributed to the development of severe fatigue symptoms for flight attendants based on a study of the timetables and fatigue symptoms of staff on international flights. In this frame, night and early morning work, long flight hours, and significant time difference disrupt the biological rhythms of individuals. Flight attendants frequently arrive early in the morning and debrief late at night on domestic flights, indicating an extremely irregular schedule. Many factors, including long work hours, regular landings, and late debriefing hours, contribute significantly to the high fatigue complaint rates. Thus, it is important to develop new measures, i.e., increased work hours, on-board rest, to improve working conditions (Ono et. al., 1991).

2.5.4. Changes in Circadian Rhythms

Flight attendants frequently experience rapid changes in circadian rhythms due to their heavy workload and irregular working environment. Circadian rhythm changes can occur when they are mildly compelled to alter their sleep or waking up time. Moreover, air travel throughout usual sleeping hours and frequent time zone shifts are necessary as a part of the job for many US air crew members, including 110.000 flight attendants. The problems surrounding the sleep cycles and circadian rhythms of flight attendants may resemble those surrounding shift workers' circadian resynchronization (Grajewski et al., 2003). Flight attendants are constantly subject to cosmic ionizing radiation,

disturbance of their circadian rhythms due to night shift work and regular time zone crossings, poor cabin air quality, elevated ozone levels, hypoxia, pesticides from cabin disinfection, excessive workplace noise, and strenuous physical job demands. The disrupted circadian rhythms are also associated with adverse mental health effects, including suicide (McNeely et al., 2018). Working schedules can include night long shifts or traveling between time zones, among other factors that contribute to sleep disruption. According to a report prepared by the Bureau of Labor Statistics in 2004, more than 15% of full-time employees were expected to work an alternate shift each month, which may include sporadic or shifting hours, evening, or night shifts, or both (Mills & Kuohung, 2019). Majority of the population, including those who do not work alternate hours, experience changes in their sleep circadian during the biannual hourly time adjustment associated with the beginning and ending of daylight savings time.

2.5.5. Time Zone Displacement

Jet lag occurs when the body is affected by time zone displacement. Jet lag is observed more when there is a daytime flight from west to east. There is a positive correlation between age and jet lag risk. Therefore, young people can adapt to biological changes much faster. The biological rhythm of body consists of a 24-hours routine. Jet lag syndrome occurs when this routine is disturbed (Jeppesen & Atlantic, 2004).

2.5.6. Sleep, Stress and Mental Disorders

Fatigue and exhaustion are common reactions of the body and can occur as a normal response to physical and mental exertion in individuals. However, fatigue is considered a safety hazard because it reduces alertness and impairs performance. Insufficient rest and sleep facilities, shift work and long working hours make pilots and cabin crew particularly prone to fatigue. Studies show that a tired pilot is more likely to make mistakes at critical moments. Many people feel dead tired at the end of a long working day, and pilots must be fully alert to make critical decisions and take action to avoid hazards (Sofianopoulos et al., 2011). However, it is quite difficult for pilots to concentrate on a safe landing after being awake for many hours. The following part explains mental and physiological effects of fatigue.

- ***Stress and anxiety:*** sizable portion of the variation in stress and anxiety could be predicted by modifiable work stressors: mental and/or psychological job demands, an imbalance between job demands and outside responsibilities, insufficient supervisor support, task uncertainty and emotional load. Numerous work stressors were discovered to be correlated, suggesting that the combined impact of these stressors may be critical for the prediction of distress (MacDonald et al., 2003). As a part of their work, flight attendants are also expected to display optimistic feelings, particularly when confronted with unpleasant or hostile passengers. Stressful emotional work can result in increased absenteeism and voluntary turnover. Competition for such roles is fierce in Taiwan where the annual attrition rate of flight attendants remains below 13%, while it reaches 40% for female flight attendants due to unstable working environment (Chen, 2006). Airlines incur costs due to high flight attendant attrition, as it results in the loss of seasoned staff and the costs with hiring new ones (Chen & Kao, 2011).

- ***Insomnia:*** Health, sex, eating habits, and the job title of cabin manager are significantly associated with high Work Ability Index (WAI) scores, while extreme work-related burnout and severe emotional distress are significantly associated with low WAI scores. In general, insomnia has the most detrimental effect on the ability of flight attendants to function. (Hu et al., 2019). 472 Taiwanese flight attendants were interviewed to determine the effects of physical, emotional, and job-related influences on their ability to work. The results showed that 43.6 percent of flight attendants suffered from insomnia that had the greatest detrimental effect on their ability to function (Vega-Escaño, et al., 2020).

2.5.7. Physical Factors

Inconsistent work hours, inadequate sleep, and a reduced consumption of nutritious food, combined with a lack of recovery and rest during work hours cause elevated health risks and an increased risk of fatigue-related injuries. Fatigue is addressed as a major organizational and personal challenge. The FAA studies on fatigue have

provided resources to policymakers in aviation industry to mitigate the effects of flight attendant fatigue on passenger safety and personal health. It is proposed that by implementing an evidence-based fatigue risk management system based on a proven flight attendant fatigue model, airline managers can ensure that adequate controls for safe operations and health safety are in place.

Many shift employees are not supplied with proper food choices, enough time, or sufficiently scheduled breaks during which they can eat in a comfortable atmosphere. It has been shown that meal scheduling and content are limited by job demands (Lessor, 1985). Consumption habits vary according to the work schedules of flight attendants. What, why, and when flight attendants eat while on the job are largely dictated by break schedules and other work constraints. Irregular eating habits have the potential to be harmful to one's health and may contribute to the rise in chronic disease. Changes in the eating habits of flight attendants may mitigate the effects of chronic disease. Interventions in improving the diet and wellbeing of flight attendants can prioritize work climate as a primary driver of eating conduct (Perrin et al., 2018). Literature also suggested that timing, and location have a significant impact on the meal habit at work, as well as how food and meals are perceived and handled by flight attendants. Nyberg and Wiklund (2017) defined the work as fragmented and inconsistent in terms of time and location, resulting in dispersed meals and a snack-based eating style. The meal situation was also marked by inconsistency and unpredictability. Consumption occurred when food was available and there was sufficient time to consume, rather than in response to hunger or social background. Numerous tactics, such as eating in advance, using emergency food, avoiding certain foods and beverages, or eating little were used to manage the unpredictability of meal situation as well as the time difference between organizational and individual times.

2.5.8. Physical Health

The physical effects of the atmosphere directly or indirectly affect the aircraft, cabin crew and passengers, and may create physiological and psychological problems. These problems occur due to the exposure to high altitude, low pressure, low temperature, cosmic radiation, speed, and accelerated movements (Lauria et al., 2006; Whelan et al., 2002). These situations experienced by flight crew affect them physically. Low

oxygen at altitude (hypoxia), pressure decrease (decompression diseases), balance and orientation disorders (disorientation, vertigo), visual illusions, motion sickness, jet lag, disorders caused by G forces (tunnel vision, vision blackout, loss of consciousness), noise, vibration, medical problems related to jumping from aircraft, fear of flying, physiological-psychological disorders in spaceflight can make it difficult for the flyers to make an efficient and safe flight, as well as may cause medical disorders and flight accidents (Waller et al., 1998).

CHAPTER III

LITERATURE REVIEW

3.1. Conceptual Framework

There are several factors that affect flight performance in the aviation industry, but the most important one is fatigue. Fatigue can be defined as a condition caused by an impaired biorhythm and by incomplete rest. Excessive fatigue arises by long-term tasks or tasks that are required to be fulfilled in a short time, while chronic fatigue occurs by the additional factors that cause fatigue over time. In mental fatigue, emotional stress is present even during rest time. Fatigue can potentially lead to unsafe situations and low productivity (Lerman et al., 2012). Pilots often operate in a difficult and stressful environment. Flight attendants are also tired of complex mission schedules that take long hours. Jet lag is almost a lifestyle for flight attendants who cannot find enough rest within the scope of flight programs that include day and night changes and different time zones.

Previous studies held on fatigue also measure the attitudes of pilots towards fatigue. They argued that biological changes and rhythm disturbances (circadian rhythm), such as lack of sleep during physiological processes or daily (24-hour intervals) sleep-wake cycle, cause fatigue on the flight crew and affect flight safety. Many pilots claim that fatigue causes distraction, prolongs reaction times, and leads to the lack of concentration and problems in aircraft control (Reis et al., 2018; Zaslona et al., 2018). Table 3.1. shows the distribution of pilots that underperformed due to fatigue in a study held on the fatigue and flight crew resource management relationship (Aktaş, 2011). The results indicate that the performance of pilots under fatigue decreased by almost 38% on average, providing an invitation to accidents.

Flight crew fatigue has been a problem in flight safety for many years. In addition to airline, cargo, commercial and non-scheduled aircraft pilots, flight attendants may face fatigue while doing their job. This poses a huge risk to aviation safety and should be treated seriously. There is a long history of discussions about pilot fatigue among regulatory authorities, airline pilots, trade unions and aircraft operators. Nowadays, flight attendant fatigue has also become an urgent issue that should be considered for flight and passenger safety. The aviation industry strives to find a solution that reduces the risks associated with fatigue for flight attendants (Signal et al., 2014).

Table 3.1. Distribution of Pilots Performing Lower Under Fatigue

Personal Occasion	%45
Decision Making	%39
Teamwork & Communication	%36
Management	%30

Fatigue is usually caused by a lack of sleep. However, the situation is not so simple. Fatigue that is also called as burnout, can manifest itself suddenly, or develops gradually over time. Some causes of fatigue are listed below (Gander et al., 2014):

- Lack of quality sleep
- Sleeping disorders,
- Daily (circadian) rhythm interruptions,
- Mental and emotional stress (family problems, anxiety, or control flight stress),
- Physical fatigue caused by heavy exercise,
- Poor health or malnutrition, including dehydration.

Flight attendants that fly long distances report sleeping lapses, and cabin crews that fly at night experience fatigue problems due to the strain on their body's natural internal clock. In the literature, many studies have discussed several conditions that cause and increase flight attendant fatigue as provided in the following part.

i. *Commuting to work:* Many flight attendants reside in an area far from their main operating base. Therefore, they must leave home earlier and drive for a long time to reach the airport to perform their flight duties. This situation causes flight attendants to start their daily life 2-3 hours earlier than other people (Brown & Whitehurst, 2012).

ii. *Body rhythm disturbance (jet lag):* Disruption of body rhythm is more common for flight attendants flying long distances and may cause problem in terms of fatigue (Strauss, 2013). The biological rhythm of body consists of a 24-hours routine. Jet lag syndrome occurs when this routine is disturbed. According to the local time of the place flight attendants fly, they may encounter jet lag since the body routine is disrupted (Jeppesen, 2004). They are also constantly subject to disturbance of the body rhythms due to night shift works, regular time zone crossings, and strenuous physical job demands (Whelan et al., 2003). These factors contribute to sleep disruption of flight attendants (Mills & Kuohung, 2019). Many airline operators provide enough time for their cabin crews to adjust their body rhythm, but when the circadian rhythm is disrupted, the body becomes stressed, making it difficult for flight attendants to sleep and stay awake during the flight (Strauss, 2013).

iii. *Waiting at airports:* Sometimes flight attendants must wait a long time at airports where they need to rest. Some of the cabin crews prefer not to sleep rather than rest, or they are unable to sleep (Orasanu, 2017). For instance, flight attendants have also watch duties other than flight duties. The flight attendant on watch duty is present in the company's office/waiting room at the airport in uniform. If a cabin crew member becomes unable to take a flight due to an excuse, the flight attendant on watch duty will be assigned to the task (Kızılcan & Demiral, 2021). Many flight attendants think that long “sits” at airports between flights should be paid given that flight attendant could not leave the airport and the “sits” cause increased fatigue (Avers et al., 2011).

iv. *Monotonous missions:* Flight attendants flying and serving in the same aircraft, and on the same routes for a long time are prone to boredom fatigue. Getting up very early and using the same route every day, staying together with the same crew for a long time, and performing monotonous flight missions in the same area for long periods with the same aircraft cause boredom (Naeeri, 2020). Monotony and boredom should be seriously considered by airline companies as they prevent

well-being and productivity (Loukidou et al., 2009). It is claimed that monotony and boredom can be harmful to health, and are associated with higher levels of fatigue, burnout, depression, and alcohol/drug consumption (Guglielmi et al., 2013; Harju et al., 2014). Therefore, the continuation of these problems can cause numerous negative consequences for individuals and companies (Harju & Hakanen, 2016).

v. *Night flights:* Flight attendants do not have regular working hours. They can take a flight at any time of the day. They must adjust their sleep and rest hours accordingly (Kızılcan & Demiral, 2021). Changing working hours, constant changes in sleep patterns, insomnia, night shifts and circadian rhythm problems of flight attendants due to their profession may cause fatigue and burnout (Konak, 2020). Especially cargo plane crews should cope with fatigue as the balance of the natural circadian rhythm of the body is disturbed during night flights when they must fly for long periods. This is particularly true for flight attendants with varying flight schedules and frequently changing day and night flight shifts (Signal et al., 2014).

The symptoms of fatigue on flight attendants can be summarized as follows:

- Falling asleep
- Yawning
- Visual acuity deterioration
- Weakness and lethargy
- Reduced reaction time
- Decreased concentration

On the other hand, the effects of fatigue can be stated as follows:

- Lack of motivation
- Inadequate performance for tasks
- Forgetfulness
- Bad judgment and loss of decision-making abilities
- Aircraft crashes and potential casualties

Fatigue is a big problem for both flight crews and flight attendants. It causes slower reaction, impaired concentration and decreased decision-making abilities. There is even a risk for pilots or flight attendants falling asleep in the cockpit or cabin during the flight. For instance, according to a survey conducted by the British Airline Pilots Association with 500 pilot members, 43% of the pilots stated that they fell asleep in the cockpit during the flight. 31% of the pilots who stated that they fell asleep in the cockpit stated that they saw the other pilot asleep when they woke up (O'hagan et al., 2017). Moreover, overlapping long periods of duty also insidiously increase fatigue and negatively affect flight and cabin safety. Getting up too early in the morning, going to the same job using the same route every day, spending a long time with the same people, and working only in a certain area cause boredom and monotony. These factors increase the fatigue of cabin crew.

3.2. Hypotheses Development

Insomnia or prolonged wakefulness is a physiological condition caused by a decrease in mental or physical performance capacity caused that impairs the alertness and ability flight attendants to operate safely. It is a non-disease-related condition that results in reduced ability to perform workload due to mental or physical stress. Fatigue has also been described as a gradual decrease in mental clarity and information processing ability by Smith et al. (2013).

There are two main factors that cause fatigue: sleep loss and circadian rhythm disturbance. In aviation, fatigue is the normal response of human body to flight-related situations that reduce performance and mental abilities, such as poor sleep, shift work, very long hours of duty. The only effective treatment for fatigue is getting enough rest and sleeping well. Fatigue is a physiological problem that cannot be overcome by training, motivation, or willpower. Tired people react more slowly to situations that require rapid cognition or physical response (Griffith & Powell, 2012). To reduce the risk of fatigue, flight attendants should have a restful sleep. Other than that, nothing reduces fatigue. Sleep duration may also vary depending on individual and environmental factors such as age, gender, body weight, physical activity, illness, emotional state, and lifestyle habits (Chen et al., 2006; Demir et al., 2017). Drawing on the preceding discussion, we develop the following hypotheses about sleep:

H_1: Sleep duration on non-working days differs according to demographic characteristics.

$H_{1.1}$: Sleep duration on non-working days differs according to age.

$H_{1.2}$: Sleep duration on non-working days differs according to gender.

$H_{1.3}$: Sleep duration on non-working days differs according to education.

$H_{1.4}$: Sleep duration on non-working days differs according to job position.

$H_{1.5}$: Sleep duration on non-working days differs according to experience.

$H_{1.6}$: Sleep duration on non-working days differs according to marital status.

H_2: Sleep duration before night flight tasks differs according to demographic characteristics.

$H_{2.1}$: Sleep duration before night flight tasks differs according to age.

$H_{2.2}$: Sleep duration before night flight tasks differs according to gender.

$H_{2.3}$: Sleep duration before night flight tasks differs according to education.

$H_{2.4}$: Sleep duration before night flight tasks differs according to job position.

$H_{2.5}$: Sleep duration before night flight tasks differs according to experience.

$H_{2.6}$: Sleep duration before night flight tasks differs according to marital status.

Sleep disorder is a health problem affecting the quality of life in the society. Waking up without adequate rest, difficulty in falling asleep, waking up frequently, frequently napping or sleeping excessively during the day, headaches and fatigue suggest sleep problems. One of the sleep disorders is sleep-onset insomnia that refers to difficulty in falling asleep. This type of insomnia may occur with people who have a hard time relaxing in bed, or whose circadian rhythm is not in sync due to factors like jet lag or irregular working schedules (Foley, 2020). Stressful lifestyle, physical inactivity, irregular bedtime, alcohol, and caffeine consumption are among the risk factors for falling asleep difficulty (Kahriman, 2001). This is more common in women, single or divorced individuals, unemployed and older people, people with low education and low socio-economic status (Gureje et al., 2009; Ohayon et al., 1995).

H_3: Difficulty in falling asleep differs according to demographic characteristics.

$H_{3.1}$: Difficulty in falling asleep differs according to age.

$H_{3.2}$: Difficulty in falling asleep differs according to gender.

$H_{3.3}$: Difficulty in falling asleep differs according to education.

$H_{3.4}$: Difficulty in falling asleep differs according to job position.

$H_{3.5}$: Difficulty in falling asleep differs according to experience.

$H_{3.6}$: Difficulty in falling asleep differs according to marital status.

H_4: Difficulty in falling asleep before flight mission differs according to the sleep quality.

H_5: Napping during flight mission differs according to the sleep quality.

In the last decades, the number of flights around the world have almost doubled. Most of the airline companies have increased their budget, created new flights to new places, and hired new employees (Boyce & Ndikumana, 2012). In recent years, the number of long non-stop flights has also risen significantly along with the passenger load. With the advancement of administrative control over working hours, total monthly flight hours are increasing and approaching to the limits set by labour management agreements. Although the number of passengers has increased, the number of flight attendants has not kept pace. Thus, an ideal work-rest balance is necessary to preserve good health and avoid fatigue symptoms (Ono et al., 1991). According to Guest (2002), the determinants of work-life balance consist of two parts: individual and organizational factors. Work demands, work culture and non-work life culture, constitute organizational factors, while individual factors consist of work orientation, personality, personal control, life and career stages, gender, and age.

H_6: The difficulty of balancing work and social life differs according to demographic attributes.

$H_{6.1}$: The difficulty of balancing work and social life differs according to age.

$H_{6.2}$: The difficulty of balancing work and social life differs according to gender.

$H_{6.3}$: The difficulty of balancing work and social life differs according to education.

$H_{6.4}$: The difficulty of balancing work and social life differs according to job position.

$H_{6.5}$: The difficulty of balancing work and social life differs according to experience.

$H_{6.6}$: The difficulty of balancing work and social life differs according to marital status.

Pain arises as a biological response due to tissue damage. Besides, pain has a dimension related to genetic, emotional, and cultural attributes, beliefs, and individual factors. Therefore, individual differences are observed in pain experience and severity, even if it occurs for similar physiological reasons (Koçoğlu & Özdemir, 2011). Being old, a woman, or divorced increase the frequency of pain. The experience of pain also shows different characteristics according to the region of residence, ethnic groups, and races. This situation indicates that pain is a complex concept that has both biological and social-cultural-psychological aspect (Koçoğlu & Özdemir, 2011).

H_7: Physical pain felt at the end of a flight differs according to demographic characteristics.

- $H_{7.1}$: Physical pain felt at the end of a flight differs according to age.
- $H_{7.2}$: Physical pain felt at the end of a flight differs according to gender.
- $H_{7.3}$: Physical pain felt at the end of a flight differs according to education.
- $H_{7.4}$: Physical pain felt at the end of a flight differs according to job position
- $H_{7.5}$: Physical pain felt at the end of a flight differs according to experience.
- $H_{7.6}$: Physical pain felt at the end of a flight differs according to marital status.

Inconsistent work hours, inadequate sleep, and reduced consumption of nutritious food, combined with a lack of recovery and rest during work hours cause elevated health risks and an increased risk of fatigue-related illnesses including immune system problems (Naktiyok & Karabey, 2005). Irregular working hours, innutritious food, dehydration in pressurized cabin, high physical workload, disruption of circadian rhythm all contribute to fatigue, and inevitably affect the immune system of flight attendants negatively. Besides, fatigue is more common in women, single or divorced individuals, unemployed and older people, people with low education and low socio-economic status (Chen et al., 2006; Demir et al., 2017; Gureje et al., 2009; Ohayon et al., 1995). Therefore, the effect of working conditions on immune system differ according to demographic attributes. Hence, we propose the following hypotheses:

H_8: The effect of working conditions on immune system differs according to demographic characteristics.

- $H_{8.1}$: The effect of working conditions on immune system differs according to age
- $H_{8.2}$: The effect of working conditions on immune system differs according to gender.

$H_{8.3}$: The effect of working conditions on immune system differs according to education.

$H_{8.4}$: The effect of working conditions on immune system differs according to title.

$H_{8.5}$: The effect of working conditions on immune system differs according to experience.

$H_{8.6}$: The effect of working conditions on immune system differs according to marital status.

It is also claimed that the short duration of online courses and the lack of interaction between the teacher and learner are important handicaps. There is a general opinion that face-to-face courses are more efficient and effective for fatigue management (Okan, 2020). Therefore, we propose the following hypothesis:

H_9: The perception of benefit from fatigue management training differs according to the course type.

CHAPTER IV

DATA AND METHODOLOGY

4.1. Data Sample

The universe of this study consists of flight attendants. The sample covers 152 flight attendants of a civil Turkish airline company that land and take off at Istanbul Airport. We exclude all participants that are not flight attendants, even if they work in the aviation industry as ground crew, administrative staff, or flight crew. The participants are selected by simple random sampling method. In this method, the probability of each unit forming the universe in the sample is the same. Hence, units have an equal chance of being selected independently of each other (Ural & Kılıç, 2005).

In the literature, determining the minimum sample size is an important issue (Jackson, Voth, & Frey, 2013). Although different studies use different sample sizes, a sample size of less than 100 is generally accepted as small, 100 to 200 as medium, 200 and above as large (Khine, 2013; Kline, 2005). According to Kline (2013), the sample size should be 10 times of the number of variables. This number is 15 times according to Stevens. However, in real life, it is not correct to set an appropriate number that fits for every situation (Lei and Wu, 2007). In this frame, our sample size is moderate and sufficient. There are some studies that used relatively small number of samples to do similar analysis (Gençoğlu, 2012; İşyapan Gürbüz & Sözen, 2016).

4.2. Data Collection

To collect the data, we used a structured survey consisting of 32 questions. We decide on questions about the personal information, fatigue and sleep level of flight attendants drawing on previous studies (Rosekind, 2000; Wollmuth 2017). The survey given in the Appendix is composed of three sections:

1. Demographic information covering age, gender, education level, job position, experience, and marital status (6 questions).
2. Sleep information assessing typical sleep patterns, sleep problems and evaluations of flight attendants about their sleep quality (7 questions)
3. Fatigue examining the assessments of the respondents about fatigue sources, fatigue countermeasures, fatigue impacts, fatigue experiences, mitigating fatigue and effectiveness of trainings to reduce fatigue (19 questions).

We collect primary data for our study by running a structured survey to the flight attendants in a Turkish airline company. Brannick (1997) claims that structured survey is a competent data collection instrument when the researcher knows exactly what data is required. The survey was administered by the Internet using Google Forms. We run the survey from December 1, 2020, to February 1, 2021. Thus, the survey was electronically available for respondents for a period of 60 days.

Before collecting the data, we asked permission via e-mail from the airline companies at which potential participants work to increase the number of flight attendants in the study. We informed the flight attendants on the aim and scope of the research. They are also communicated that this study was scientific, not an evaluation questionnaire by a company and we will treat all answers confidential. The anonymity of participants was ensured by not asking any question about his or her personality or company information in the survey.

Although 300 potential respondents were contacted, only 152 of them filled in the online questionnaire. The main reason for this low response rate was Covid-19 pandemic crisis since we had difficulty in reaching participants due to the pandemic. Another reason is the busy working hours. Flight attendants work in a dynamic and busy industry that they hardly find time to answer the questionnaire.

4.3. Research Methodology

The questions of the survey are developed similarly to the studies of Rosekind (2000) and Wollmuth (2017) to compare the results. Rosekind conducted a survey focusing

six main subjects, namely demographics, sleep habits, flight experience, duty and rest patterns, fatigue, and work environment, while Wollmuth concentrated on demographic attributes, targeted duty information, sleep information, fatigue, management, and work environment. Our survey collected data on demographic characteristics, sleep quality, fatigue experience, impacts of fatigue, strategies to mitigate fatigue, and fatigue training programs. Rosekind applied his survey to pilots, while Wollmuth expanded the scope by including flight mechanics, flight attendants, maintenance, and administrative personnel. Our study conducted the survey only for flight attendants. Thus, we expect that this study will improve the understanding of fatigue by focusing on a specific occupational group in the aviation industry.

The research methodology is designed to investigate how the socio-demographic and professional characteristics of flight attendants affect the fatigue level and sleep quality. Then, we used SPSS for Windows v.28 to analyse the data and find out the results for the hypotheses. The findings were checked at 5% significance level and 90% and 95% confidence interval.

First, we examine the means, frequencies, and percentage distributions of the demographic characteristics of participants and their answers. Then, we conducted t-tests and ANOVA analyses to determine whether the fatigue, burnout, and sleep levels of flight attendants differ according to the demographic characteristics.

4.4. Assumptions and Limitations

We assume that volunteer participants in the sample gave correct and sincere answers to measure the research hypotheses. However, different results could be obtained by collecting data from a different sample group. Similarly, more explanatory results can be derived by running a survey that includes other variables that have impact on fatigue. Another limitation of the study is the Covid-19 pandemic that affected the time allocated for the research due to getting necessary permissions and reaching enough number of participants. The cross-sectional nature of the study is another limitation. The instantaneous collection of data for a single time-period in cross-sectional studies does not include the effect of changes in the relationship between the variables, causing the results of the research to deviate. A longitudinal study may yield different results.

Finally, the scales used in the survey were based on self-reporting, that is, no one else evaluated the participant, and the participant himself/herself answered the questions in the survey. Therefore, even though the anonymity is ensured, the responses of the participants to the questions regarding their profession may raise the possibility of negative effects such as bias or fear in answering the questions.

CHAPTER V

EMPIRICIAL FINDINGS

5.1. Descriptive Statistics

In this section, we provide the summary of descriptive statistics about the survey results in terms of demographics, sleep, fatigue, and management. We also compare the results with the findings of other similar studies.

5.1.1. Demographics

Table 5.1. presents the distribution of the demographic characteristics of participants (N=152) who answered the questionnaire. Majority of the participants (51 percent) ranges between 25-30 ages (N=78), while the participants over the age of 41 cover the smallest group (N=9). The size of other age groups is sorted as follows: 31-35 (N=39), 18-24 (N=16) and 36-40 (N=10). In terms of gender, majority of the participants are female (N=111), while in terms of marital status, 44 participants are married, and 108 of them are single.

When we look at the education background, most of the participants have a bachelor's degree (N=97). Among the remaining 29 participants, 25 of them have a college graduate degree, and 4 of them have a high school degree. Only 26 participants have postgraduate degree.

Most of the participants work as cabin crew (N=129). Besides, 15 cabin chief and 8 pursers responded to the questionnaire. When we checked the experiences of the participants, we observe that the group sizes are getting smaller as years of experiences increase. Accordingly, the groups were sorted as <5 years of experience (N=86), 5-10 years of experience (N=47), 11-15 years of experience (N=9), 16-20 years of experience (N=6) and over 21 years of experience (N=4).

Table 5.1. Demographics Results of the Survey

		N	%
Age			
	18-24	16	10
	25-30	78	51
	31-35	39	26
	36-40	10	7
	41+	9	6
Gender			
	Female	111	73
	Male	41	27
Education Level			
	High School Degree	4	3
	College Graduate Degree	25	16
	Bachelor's Degree	97	64
	Master’s Degree	25	16
	Doctorate Degree	1	1
Job Position			
	Cabin Crew	129	85
	Cabin Chief	15	10
	Purser	8	5
Experience			
	<5 years	86	56
	5-10 years	47	31
	11-15 years	9	6
	16-20 years	6	4
	21 years and above	4	3
Marital Status			
	Married	44	29
	Single	108	71

5.1.2. Sleep

The participants were first asked about the hours of sleep they get on average on their days off duty. The results for sleep duration on days off duty were: “less than 4 hours” (1 percent), “4-6 hours” (6 percent), “6-8 hours” (45 percent) and “more than 8 hours” (48 percent). Thus, it seems that 93% of the participants get a good sleep on their days off duty. The participants were also asked how many hours of sleep they usually get when they were at layover with minimum rest time (12 hours or less). The results for sleep duration at layover are: “less than 4 hours” (17 percent), “4-6 hours” (46 percent), “6-8 hours” (32 percent) and “more than 8 hours” (5 percent). These results indicate that minimum rest time at layover of 12 hours is obviously insufficient for flight attendants to get enough sleep and rest before returning his or her flight mission. This is because minimum 12 hours rest time includes leaving the aircraft and airport, transportation to hotel, sleep, and preparing for returning flight. For female flight attendants, the preparation time also includes make-up and hairdressing. Finally, the participants were asked how many hours of sleep they get on average before night-time flights. The results for sleep duration before night-time flights are: “less than 4 hours” (60 percent), “4-6 hours” (14 percent), “6-8 hours” (19 percent) and “more than 8 hours” (7 percent). This result shows that the flight attendants have difficulty in sleeping before night-time flights. This may have negative effects on their performance. Figure 5.1. compares the sleep durations for days off duty, layover, and night duty. According to these results, the flight attendants have the longest sleep duration on the days off duty. The sleep durations are shortened at layovers, and they have the shortest sleep durations before night flights. Table 5.2. shows the descriptive statistics for sleep duration on days-off, layovers, and before night flight duties.

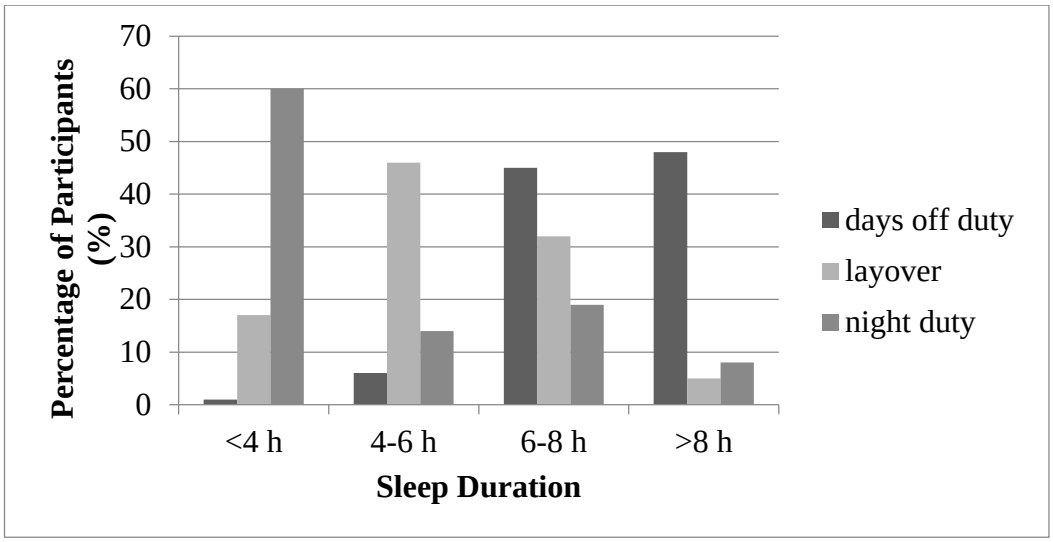

Figure 5.1. Sleep Duration on Days-off Duty, Layover and Night Duty

Table 5.2. Sleep Duration on Days-off, Layover and Before Night Flights

Questions	Less than 4	4 to 6	6 to 8	More than 8	Mean	Standard Deviation
On your days off duty, what is the total amount of sleep you get on average?	1 0.7	9 5.9	68 44.7	74 48.7	3.42	0.63
When you are at layover with minimum rest time (12 hours or less), how many hours of sleep do you usually get?	26 17.1	69 45.4	49 32.2	8 5.3	2.25	0.80
How many hours of sleep you get on average before night-time flight?	91 59.9	21 13.8	29 19.1	11 7.2	1.73	1.00

Another question of the survey measures how often the participants have troubles to fall asleep before flight duty. Table 5.3. presents the results. The responses indicate that only one percent of the participants “never” have troubles. 28 percent of the participants have troubles “sometimes”, 46 percent of them have troubles “usually”,

and 24 percent of them have troubles “very often” to fall asleep before flight duty. In line with this result, over 80 percent of the respondents reported that they “never” get enough sleep (36 percent) or “sometimes” get enough sleep (53 percent), while 11 percent “usually” get enough sleep and 1 percent “always” get enough sleep before night-time or early morning flights. These results show that the participants mostly have trouble falling asleep and do not sleep enough. Considering that insufficient sleep may cause stress and decrease physical and cognitive abilities and thus, negatively affect duties of flight attendances especially for safety, this issue is an important problem that should be addressed by airline companies.

We also asked the participants how often they use over-the-counter, prescription medication, or a supplement to help them fall asleep. Figure 5.2. and Table 5.4. show the medication usage rates. The results are in line with the previous studies (Rosekind, 2000; Wollmuth, 2017). Despite the sleep problem, most of the participants do not use medication to impair their sleep quality. One reason may be the procedures of airline companies. Some companies have strict procedures that forbidden to use medication because of its side effects that may affect psychological and cognitive abilities of flight attendants and may endanger flight safety.

Table 5.3. Results on Falling Asleep and Getting Enough Sleep

Questions	Always	Usually	Sometimes	Never	Mean	Standard Deviation
How often do you have troubles to fall asleep before flight duty?	37 24.3	70 **46.1**	43 28.3	2 1.3	2.06	0.76
Do you think that you get enough sleep before night time or early morning flights?	1 0.7	17 11.2	80 **52.6**	54 35.5	3.23	0.66

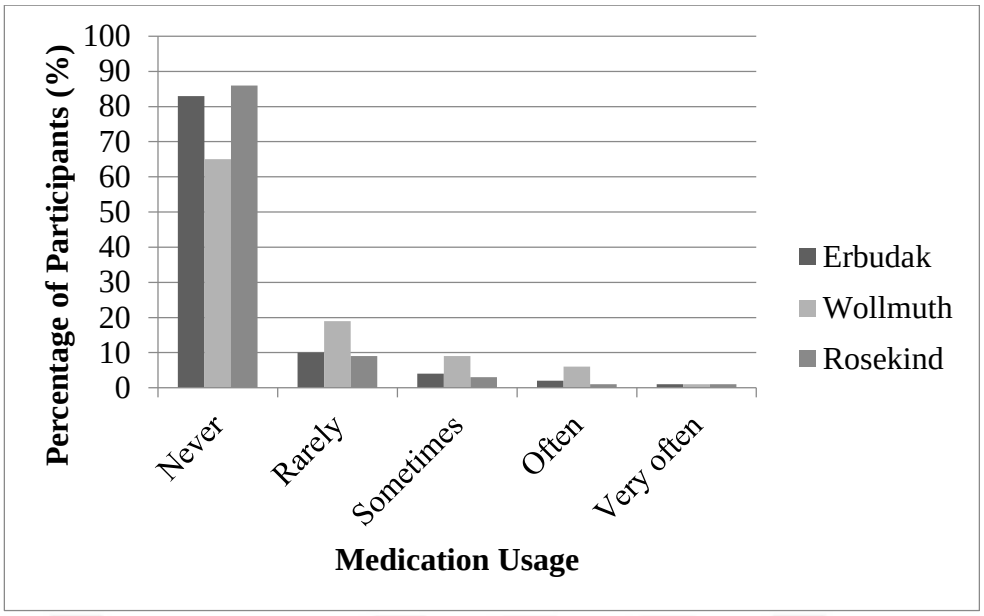

Figure 5.2. Medication Usage Rate Comparison

Table 5.4. Medication or Supplement Usage

Questions	Very Often	Often	Sometimes	Rarely	Never	Mean	Standard Deviation
How often do you use over-the-counter or prescription medication, or a supplement to help you fall asleep?	1 0.7	3 2.0	6 3.9	15 9.9	127 **83.6**	4.73	0.68

Over 70 percent of the respondents reported that they nap during the flight (71 percent). When we compare the results in Figure 5.3 with those of in Figure 5.2, we can argue that although sleep seems to be an important problem for our sample, the participants reported less sleep problems than Wollmuth (2017). The results indicate that the majority of the flight attendants unwillingly nap during flight mission. Given the fact that flight attendants have significant security roles that require immediate attention, being unable to respond to such cases is alarming. For instance, flight attendants have a first aid certificate and have the authority to intervene. In an

emergency case, napping may cause delays in responding. Similarly, there may be a risk of incomplete or late fulfilment of security duties such as tasks related to turbulence and cabin security before take-off and landing.

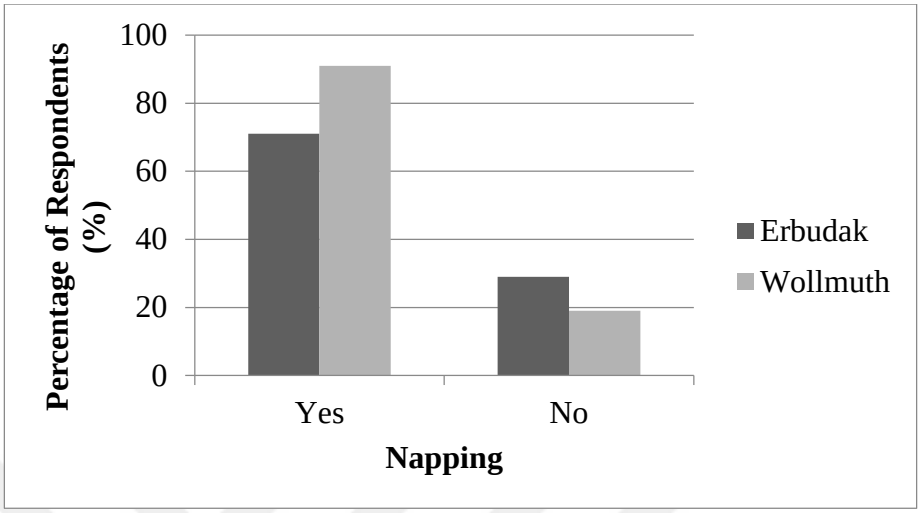

Figure 5.3. Napping of Flight Attendants

Overall, the respondents evaluate their sleep quality as “very good” (5 percent), “good” (24 percent), “fair” (53 percent), “poor” (17 percent) and “very poor” (1 percent). According to these results, the general evaluation of the participants' sleep quality is at an average level. One likely reason for the participants' "optimistic" evaluation of the sleep quality despite their relatively high level of sleep problems may be that they assign different meanings to the sleep quality.

5.1.3. Fatigue

To measure the cause and effects of fatigue, we asked a series of questions to the participants. First, we asked them to select the factors that cause fatigue in civil aviation operations from a list of 10 items. Table 5.5 and Table 5.6 show the results. The most often identified item is “minimum rest time layovers” in the top five choices by 14 percent of the respondents. “Long duty days” is the second (13 percent), “night flights” is the third (13 percent), “consecutive days of working” is the fourth (13 percent) and “4 legs flight duty” (12 percent) is the fifth most selected factor (Table 5.4.).

Table 5.5. Top Five Factors that Cause Fatigue

Factors	Frequency	Percent
Minimum rest time layovers	119	14
Long duty days	111	13
Night flights	110	13
Consecutive days of working	110	13
4 legs flight duty	101	12

The “minimum rest period” of flight attendants at layovers is 12 hours or even less in some airline companies. This period begins just after the aircraft engine shuts down. The processes of leaving the plane and then the airport and going to city center or to a hotel in another location are included within that minimum rest period. The preparation of flight attendants for the return flight is also included in the same layover period. The flight attendants are also recommended by their companies to sleep for 8 hours before each flight. Therefore, the flight attendants do not have enough time to sleep and rest. The second and fifth selected factors, namely “long duty days” and “4 legs flight duty”, are related to each other. Due to short flight time in domestic flights, 4-leg flight missions can be planned. However, flight attendants may be more tired than a 2-legged international flight. The reason is that many tasks such as take-off and landing, boarding, safety demonstration are repeated 4 times and the workload increases. Apart from this, one of the reasons for selecting "long duty days" factor is long international flights and extended range (ER) flights, i.e., transoceanic flights. In ER flights, flight attendants always work on wide-body flights. On these flights, they make service more than once in a single flight, and they also fly to a country in a different time zone.

“Consecutive days of working”, the third mostly selected factor, also significantly increases fatigue for flight attendants. The crew planning department has the authority to plan a day flight after night flights connecting two days and this happens frequently. According to international laws, such a plan can be made if “minimum rest time” due is given. However, the sleep patterns and circadian rhythms of flight attendants returning from a night flight are disrupted and flights take place without scheduled free days in a row, thus fatigue occurs.

Almost all participants (97 percent) claimed that fatigue is a “moderate” or “serious” concern in civil aviation operations (Figure 5.4). 99 percent of the participants stated that fatigue is a “moderate” or “serious” safety issue when it occurred (Figure 5.5). Table 5.7 shows the descriptive results, while Figure 5.4 and Figure 5.5 compares the results with the previous studies held by Wollmuth (2017) and Rosekind (2000).

Table 5.6. Factors that Cause Fatigue

Question: Please choose the factors that cause fatigue in civil aviation operations	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Long duty day	111	**13.3**	13.3
4 legs flight duty	101	12.1	25.4
Night flights	110	**13.2**	38.6
Early morning departures	85	10.2	48.8
Minimum rest time layovers	119	**14.3**	63.1
Heavy workload	61	7,3	70.4
Consecutive days of working	110	**13.2**	83.6
Innutritious meals	53	6.4	89.9
No or few breaks	60	7.2	97.1
Cabin temperature	24	2.9	100.0
Total	834	100.0	

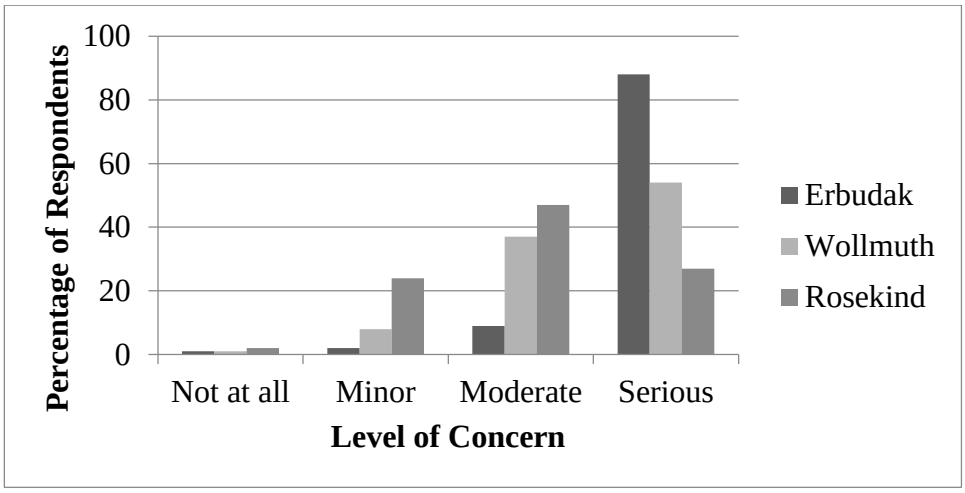

Figure 5.4. Level of Fatigue Concern – A Comparative Analysis

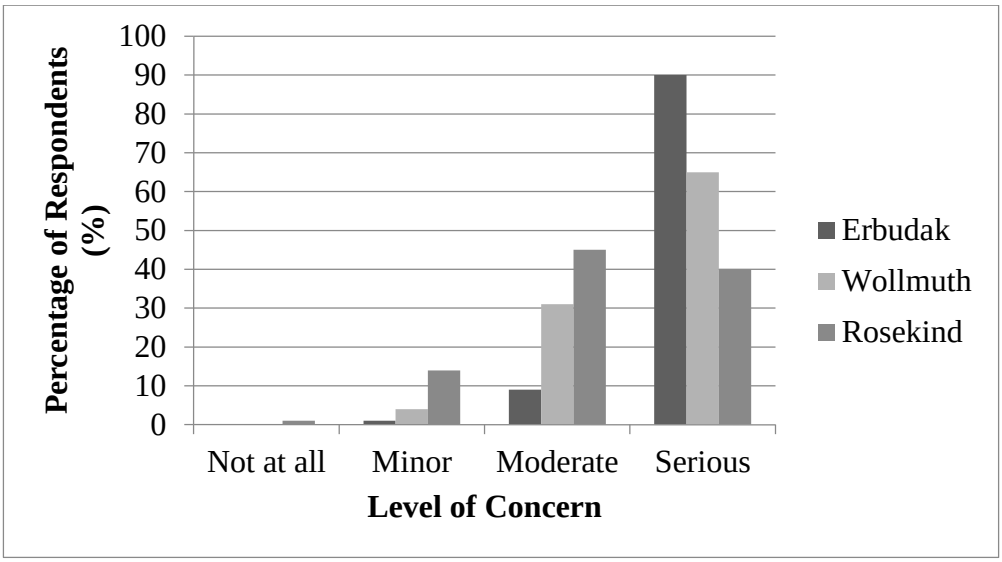

Figure 5.5. Fatigue as a Safety Issue – A Comparative Analysis

Table 5.7. Fatigue as a Concern and Safety Issue in Civil Aviation

Questions	Serious	Moderate	Minor	Not at all	Mean	Standard Deviation
In your opinion, to what extent is fatigue a concern in civil aviation operations?	134 88.2	13 8.6	4 2.6	1 0.7	1.15	0.47
When fatigue occurs, how significant a safety issue is it?	137 90.1	14 9.2	1 0.7	0 0	1.11	0.37

When we asked the participants to identify how fatigue affects their performance, they selected “tiredness” (89 percent), “concentration” (70 percent), “alertness” (68 percent) and “errors” (55 percent) as the most important impacts. Other impacts identified by the participants were sorted as follows: “slow reaction” (55 percent), “mood change” (47 percent), “apathy” (43 percent), “CRM skills” (42 percent), “judgement” (33 percent), “omissions” (27 percent), “motor skills” (22 percent) and “memory” (20 percent). Table 5.8 shows the results and Figure 5.6. compares them with the findings of Wollmut (2017).

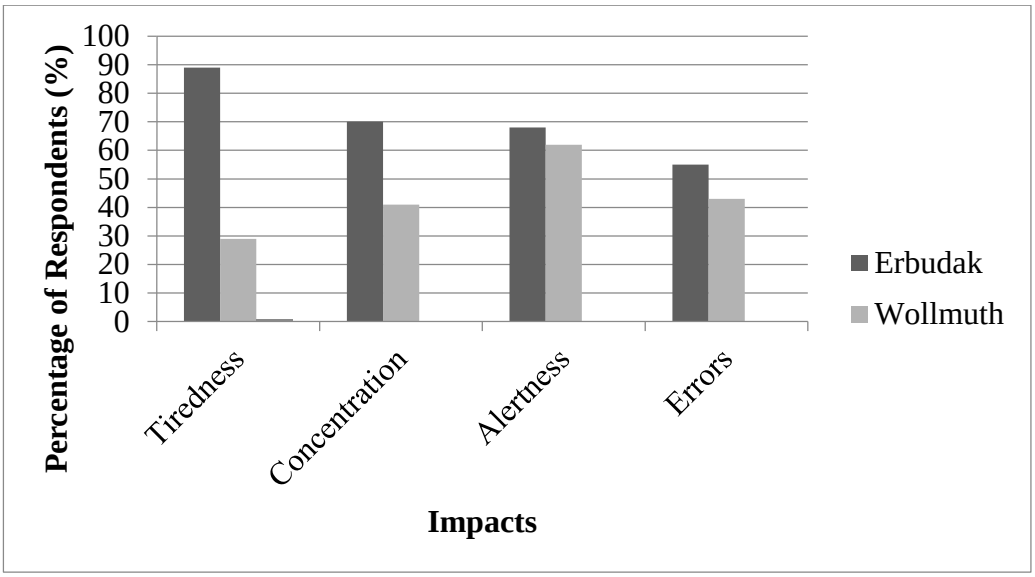

Figure 5.6. The Top Four Impacts of Fatigue on the Performance of Flight Attendants

These factors may cause security and emergency problems. For example, disarming and arming slides at aircraft doors before and after each flight is a task that requires attention. If this task is not executed properly, the aircraft door opens, the slides explode, the flight operation disrupts, and the company incurs great costs. These effects may also cause disruption of the duties of securing passengers and cabin before each take-off and landing, and a safe flight will not occur. Finally, in an evacuation case, cabin crews cannot perform perfectly, and mistakes may endanger human life.

In addition, more than half of the participants (62 percent) stated that the most disruptive phase of flight by fatigue is landing (36 percent) or descent (26 percent). Other flight phases are sorted as follows: cruise (23 percent), taxi (12 percent) and take off (3 percent). Table 5.9 shows the summary of the findings. Since the descent and landing phases constitute the end of a flight mission, it seems reasonable that the intensity of the answers is gathered in these two phases. Considering that 40% of all threats experienced during the flight occur during the descent and landing phases (Helmreich, 1999, p. 142), one may argue that the fatigue in these two phases may pose a significant risk for flight safety.

Table 5.8. Impacts of Fatigue on the Performance of Flight Attendants

Question: In which of the following ways does fatigue affect your performance? (Select all that apply)	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Alertness/attention	103	11.9	11.9
Omissions	41	4.7	16.6
Apathy	65	7.5	24.1
Judgement	50	5.8	29.9
Slow reaction	83	9.6	39.4
Errors	84	9.7	49.1
Concentration	106	**12.2**	61.4
Motor skills	34	3.9	65.3
Mood change	72	8.3	73.6
Tired/Sleepy	135	**15.6**	89.2
Memory	30	3.5	92.6
Crew resource management skills	64	7.4	100.0
Total	834	100.0	

Table 5.9. The Most Disruptive Phase of Flight by Fatigue

Question: In your opinion, which phase of the flight is the most affected by fatigue?	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Taxi	18	11.8	11.8
Take off	5	3.3	15.1
Cruise	35	23.0	38.2
Descent	40	26.3	64.5
Landing	54	**35.5**	100.0
Total	152	100.0	

The participants also stated that short or medium-haul international flights make them exhausted the most in terms of flight types (51 percent). The second most exhausting

flight type is long-haul (ER) international flights (39 percent), and the least exhausting flight type is domestic flights (10 percent). Table 5.10 shows the results. On short and medium-haul international flights, flight attendants usually perform more than one flight duty in a day, handling tasks related to take-off and landing more than once with excessive passenger service. But as flight attendants have to layover on transoceanic ER flights, they have opportunity to rest. Therefore, ER flights are less tiring than short and medium-haul flights, even if they have longer distances. The reason why the domestic flights are chosen as the least exhausting flight type may be attributed to short and relatively easy passenger service. Excessive fatigue is caused by long-term tasks or tasks that should be executed in a short time (Papanikou et al., 2020). In this context, long-term and short-term flight duties have their own fatigue factors and affect the cabin crew at different levels.

When the participants were asked whether they ever wanted not to fly due to fatigue, 12 percent of them answered “no”, while the rest answered “yes” (87,5 percent). This result is dramatic because it indicates that majority of flight attendants (87,5 percent) have experienced fatigue at least once and they had to go to flight duty while experiencing fatigue. This outcome demonstrates not only physical and mental difficulties of flight attendants but also security and emergency risks undertaken during flight operations.

Table 5.10. The Most Exhausting Flight Type

Question: Which type of flight duty does make you more exhausted?	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Domestic flights	15	9.9	9.9
Short or medium-haul international flights	78	51.3	61.2
Long-haul (ER) international flights	59	38.8	100.0
Total	152	100.0	

Table 5.11. Unwillingness to Fly due to Fatigue

Question	Yes	No	Mean	Standard Deviation
Have you ever not wanted to fly because you were too tired?	133 **87.5**	19 12.5	1.12	0.33

When we looked at the physical symptoms that the participants felt the most after the end of duty, we observe two main symptoms: back pain (49 percent) and foot pain (33 percent). The respondents also reported joint pain (9 percent) and shoulder/elbow/wrist/hand pain (2 percent). Seven percent of the participants reported no physical symptom (Table 5.12). When the participants were asked how often they felt apathy or emotional exhaustion, half of them replied as "sometimes" (50 percent), while the other half answered as follows: "rarely" (30 percent), usually (18 percent) and never (2 percent) (Table 5.13). In line with this situation, when the respondents were asked whether it is hard to smile to the passengers in a bad day, they answered as follows: "rarely" (46 percent), "usually" (30 percent), "never" (15 percent) and "always" (9 percent) (Table 5.14). The fact that majority of the participants feel emotional exhaustion and exhibit a superficial behaviour such as smiling to passengers forcibly is evaluated as complying with the rules, not to help the customer, but to keep their job (Grandey, 2003).

Table 5.12. Physical Symptoms Felt After Flight

Question: At the end of your duty, which physical symptom do you feel the most?	Frequency	Percentage (%)	Cumulative Percentage (%)
Back pain	75	**49.3**	49.3
Foot pain	51	**33.6**	82.9
Shoulder/elbow/wrist/hand pain	3	2.0	84.9
Joint pain	13	8.6	93.4
None of them	10	6.6	100.0
Total	152	100.0	

Table 5.13. Feeling Apathy or Emotional Exhaustion

Question	Usually	Sometimes	Rarely	Never	Mean	Standard Deviation
How often do you feel apathy or emotional exhaustion?	27 17.8	76 **50.0**	46 30.3	3 2.0	2.16	0.73

Table 5.14. Difficulty of Smiling to Passengers

Question	Always	Usually	Rarely	Never	Mean	Standard Deviation
When you are having a bad day, is it hard for you that you have to smile to passengers most of the time?	14 19.2	46 30.3	70 **46.1**	22 14.5	2.65	0.83

Finally, the respondents were asked to what extent their company show concern for the health of the employees. The answers were sorted as: “to a moderate extent” (57 percent), “to a minimum level” (21 percent), “to a great extent” (17 percent) and “not at all” (5 percent) Table 5.15 shows the results. Considering the importance of human capital and possible negative effects of a problem arising from employee unhealthiness, airline companies should be more concerned on the health of employees.

Table 5.15. Company Concern for Employee Health

Question	To a great extent	To a moderate extent	To a minimum level	Not at all	Mean	Standard Deviation
To what extent, does your company show concern for employees' overall health?	25 16.4	87 **57.2**	32 21.1	8 5.3	2.15	0.75

5.1.4. Management

A series of two questions were asked to the participants to pick up from a list of fatigue mitigation techniques during pre-trip and post-trip. The top three strategies reported for pre-trip are caffeine (72 percent), napping (58 percent) and drinking plenty of water (55 percent) (Figure 5.7.). On the other hand, the top three strategies reported for post-trip are shower (88 percent), napping (80 percent) and drinking plenty of water (51 percent) (Figure 5.8.). When we compare the answers with the findings of the Wollmuth, the participants use the same techniques for relaxation.

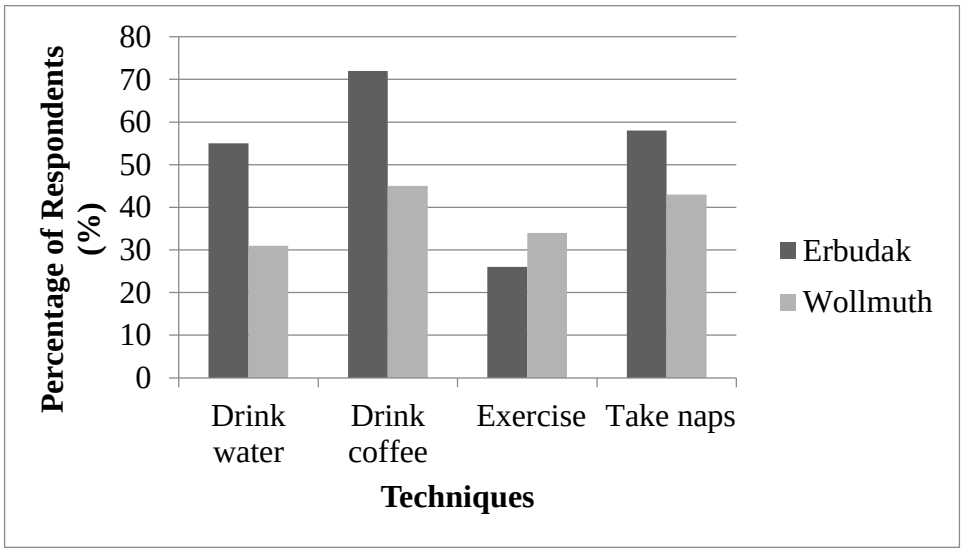

Figure 5.7. Pre-Trip Fatigue Mitigation Techniques

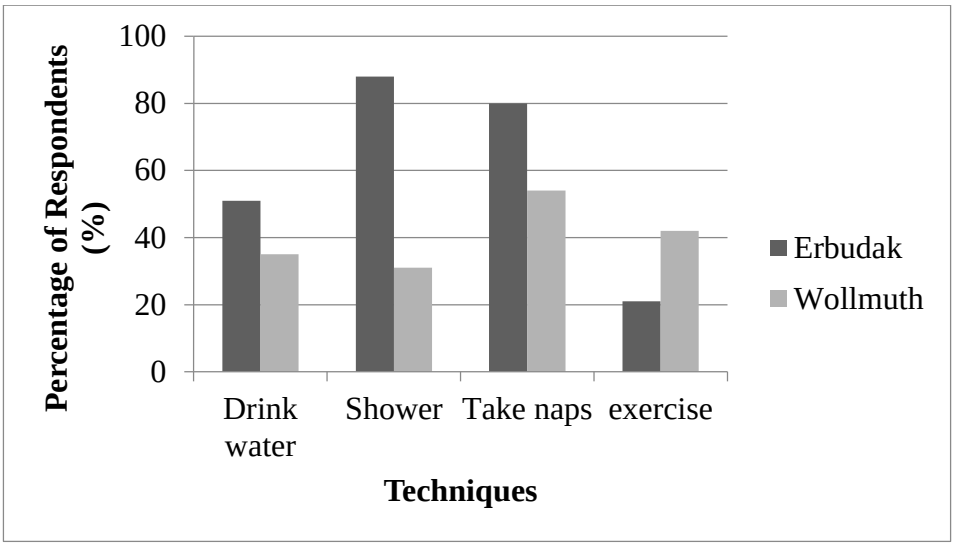

Figure 5.8. Post-Trip Fatigue Mitigation Techniques

Table 5.16. Fatigue Mitigation Techniques Before Flight Duty

Question: Which strategies do you use to manage fatigue prior to a flight? (Select all that apply)	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Drink plenty of water	84	**18.5**	18.5
Take a shower	72	15.9	34.4
Drink coffee	109	**24.0**	58.4
Exercise	40	8.8	62.2
Take naps	88	**19.4**	86.6
Take vitamins	60	13.2	98.8
Use drugs	1	0.2	100.0
Total	454	100.0	

According to the results, napping and drinking plenty of water before and after the flight duty are within the top-three mitigation techniques. The fact that napping is mostly selected factor presents consistency with the outcomes identified in sleep section. Many flight attendants probably take naps especially before night flight duties because the results show that majority of cabin crews cannot get enough sleep before

night flights. Similarly, due to not getting enough sleep and disruption of circadian rhythm, flight attendants feel the need for taking naps after flight. The second commonly selected factor "drinking plenty of water" may be attributed to the fact that human body becomes dehydrated due to a lack of moisture in the cabin during the flight. Therefore, the flight attendants should consume plenty of water not only during the flight but also before and after each flight duty.

Finally, the participants picked up the items from a list of twelve suggested methods of reducing fatigue in civil aviation operations. The results are presented in Table 5.18.

Table 5.17. Fatigue Mitigation Techniques After Flight Duty

Question: Which strategies do you use to manage fatigue after a flight? (Select all that apply)	**Frequency**	**Percent**	**Cumulative Percent**
Drink plenty of water	77	**17.0**	17.0
Take a shower	133	**29.4**	46.4
Drink coffee	43	9.5	55.8
Exercise	32	7.1	62.9
Take naps	122	**26.9**	89.8
Take vitamins	35	7.7	97.6
Use drugs	2	0.4	98.0
Drink alcohol	9	2.0	100.0
Total	453	100.0	

Table 5.18. Methods Suggested by Participants to Reduce Fatigue in Civil Aviation

Methods	**N**	**Percent**	**Wollmuth**
Improve scheduling	121	80%	83%
Improve rest time	112	74%	80%
Reduce consecutive days	106	70%	71%
Train management about fatigue	103	68%	69%
Limit late night flights	92	61%	

Table 5.18. (cont.)

Augment crews	88	58%	
Duty time limits	78	51%	85%
Limit early departure flights	68	45%	
Increase company support	58	38%	
Opportunity to switch duties between crew members	48	32%	
Improve days off	38	25%	
More effective training about fatigue to crew-members	12	8%	

In the survey, we asked the flight attendants to give their suggestions to reduce fatigue in civil aviation operations from a list of options. Table 5.19. shows the results. The top three most selected methods are “improve scheduling” (13.1 percent), “improve rest time” (12.1 percent) and “reduce consecutive days” (11.5 percent). The findings indicate that the most selected suggestions are all about scheduling. It is mentioned that if the minimum rest time is applied, crew planning department can publish flight plans in which a daytime flight follows a night flight and vice versa for consecutive days. To prevent such scheduling practices, reducing consecutive days of flight plans, improving rest times between flights and at layovers and improving scheduling in general will help airline companies to reduce fatigue experienced by the employees.

Table 5.19. Methods Suggested by Participants to Reduce Fatigue in Aviation

Question: In your opinion, which changes could be done to reduce fatigue in civil aviation operations? (Select all that apply)	**Frequency**	**Percentage (%)**	**Cumulative Percentage (%)**
Duty time limits	78	8.4	17.0
Improve scheduling	121	**13.1**	46.4
Improve rest time	112	**12.1**	55.8
Improve days off	38	4.1	62.9
Train management and crew planning department about fatigue	103	11.1	89.8

Table 5.19. (cont.)

More effective training about fatigue to crew-members	12	1.3	97.6
Augment crews	88	9.5	98.0
Limit early departure flights	68	7.4	100.0
Limit late night flights	92	10.0	77.1
Reduce consecutive days	106	**11.5**	88.5
Increase company support	58	6.3	94.8
Opportunity to switch duties between crew members	48	5.2	100.0
Total	924	100.0	

5.2. Statistical Test Results on Demographic Characteristics

5.2.1. Gender

For gender, the answers of the flight attendants were analyzed by using independent t-test. Table 5.20 shows the results. According to the findings, the work and social life balance shows a significant difference as $p=0.009$ $df_{150}<0.05$ at the 95% confidence interval regarding gender of flight attendants. The mean value for female flight attendants that have difficulty in balancing work and social life is lower than the mean value of male flight attendants (2.59>2.29). This result indicates that men have more difficulty in balancing work and social life than women, supporting our sixth hypothesis ($H_{6.2}$). Although this result might be surprising, men struggle as much as women to balance work and social life. They carry household affairs and give care for children. The changing roles in social life and working in a job that requires to stay away from home can make it hard to maintain healthy work and social life for men.

5.2.2. Age

We measure the results for age by using One-Way analysis of variance (ANOVA) test. Table 5.21 shows the results. According to the findings, there is a significant difference between the age and the sleep time before night flight duty as $p=0.036$ $df4\text{-}147<0.05$ at the 95% confidence interval. The average sleep time before night flight duty of flight

attendants aged between 25-30 is lower than the average sleep time of flight attendants over 41 years old. This result supports our second hypothesis ($H_{2.1}$) and shows that young cabin crews still try to adopt to irregular working hours and may have sleep anxiety due to stress or fear of not getting enough sleep before night flights. The result also indicates that older flight attendants have better strategies to schedule their sleep cycle and more easily fall asleep during daytime hours. Thus, they have high average of sleep hours before night flights than younger cabin crews.

Table 5.20. Independent t-Test on the Gender of Flight Attendants

Questions	Gender	N	Mean	Standard Deviation	Df	t	p
On your days off duty, what is the total amount of sleep you get on average?	Female	111	3.46	0.61	150	1.442	0.151
	Male	41	3.29	0.68			
How many hours of sleep you get on average before night time flights?	Female	111	1.64	0.95	150	-1.651	0.104
	Male	41	1.97	1.12			
How often do you have troubles to fall asleep before flight duty?	Female	111	2.06	0.80	150	-0.072	0.942
	Male	41	2.07	0.64			
How often do you find it difficult to balance your work and social life?	Female	111	2.59	0.60	150	2.629	**0.009***
	Male	41	2.29	0.68			
At the end of your duty, which physical symptom do you feel the most?	Female	111	1.9	1.18	150	0.104	0.918
	Male	41	1.88	1.26			

Table 5.20. (cont.)

Do you think that your immune system is affected negatively due to working conditions?	Female	111	1.20	0.40	150	-0.61	0.543
	Male	41	1.24	0.43			

Table 5.21. ANOVA test Results for Age

Questions	Age	N	Mean	Standard Deviation	df	t	P
On your days off duty, what is the total amount of sleep you get on average?	18-24	16	3.25	0.577	4 147	0.583	0.676
	25-30	78	3.41	0.633			
	31-35	39	3.49	0.556			
	36-40	10	3.30	0.949			
	41 +	9	3.56	0.726			
How many hours of sleep you get on average before night time flights?	18-24	16	1.56	0.964	4 147	2.648	**0.036***
	25-30	78	1.65	0.965			
	31-35	39	1.67	0.927			
	36-40	10	2.10	0.994			
	41 +	9	2.67	1.414			
How often do you have troubles to fall asleep before flight duty?	18-24	16	1.81	0.834	4 147	0.544	0.704
	25-30	78	2.09	0.759			
	31-35	39	2.13	0.695			
	36-40	10	2.10	0.994			
	41 +	9	2.00	0.707			
How often do you find it difficult to balance your work and social life?	18-24	16	2.63	0.500	4 147	0.511	0.728
	25-30	78	2.46	0.638			
	31-35	39	2.56	0.680			
	36-40	10	2.40	0.699			
	41 +	9	2.67	0.707			

Table 5.21. (cont.)

At the end of your duty, which physical symptom do you feel the most?	18-24	16	2.38	1.628	4 147	1.213	0.308
	25-30	78	1.81	1.163			
	31-35	39	2.03	1.224			
	36-40	10	1.50	1.527			
	41 +	9	1.67	1.000			
Do you think that your immune system is affected negatively due to working conditions?	18-24	16	1.25	0.447	4 147	0.101	0.982
	25-30	78	1.19	0.397			
	31-35	39	1.23	0.427			
	36-40	10	1.20	0.422			
	41 +	9	1.22	0.441			

5.2.3. Marital Status

We measure the relationship between marital status and sleep by employing independent t-test. Table 5.22 shows the results. According to the findings, the work and social life balance shows a significant difference at the 90% confidence interval ($p=0.066$ $df_{150}<0.10$). This result indicates that married flight attendants have more difficulty to balance work and social life than single ones, supporting our sixth hypothesis ($H_{6.6}$). This finding is reasonable since married people are expected to have more responsibilities in social life than single people, especially if they have kids. Flight attendants do not only work outside of regular working hours but also in the weekends and national holidays. Thus, their flight schedule usually collides with other households' off-days.

Table 5.22. Independent t-Test Results on the Marital Status of Flight Attendants

Questions	**Marital Status**	**N**	**Mean**	**Standard Deviation**	**df**	**t**	**p**
On your days off duty, what is the total amount of sleep you get on average?	Married	44	3.43	0.661	150	0.214	0.831
	Single	108	3.41	0.627			

Table 5.22. (cont.)

How many hours of sleep you get on average before night time flights?	Married	44	1.61	0.970	150	-0.961	0.338
	Single	108	1.79	1.024			
How often do you have troubles to fall asleep before flight duty?	Married	44	2.14	0.852	150	0.729	0.467
	Single	108	2.04	0.722			
How often do you find it difficult to balance your work and social life?	Married	44	2.36	0.750	150	-1.851	**0.066***
	Single	108	2.57	0.583			
At the end of your duty, which physical symptom do you feel the most?	Married	44	1.86	1.069	150	-0.203	0.839
	Single	108	1.91	1.257			
Do you think that your immune system is affected negatively due to working conditions?	Married	44	1.11	0.321	150	-2.131	**0.062***
	Single	108	1.25	0.435			

In the survey, we asked participants "Do you think that your immune system is affected negatively due to working conditions?". The results were remarkable. Majority of the flight attendants' (78.9%) said "Yes" (Figure 5.9.). Working conditions including both physical conditions and interpersonal relationships make the flight attendants prone to weak immune system. In terms of physical conditions, flight attendants always work indoors, in a cabin with pressurized air and exposed to constant noise and radiation. In terms of interpersonal relationships, they are always in contact with other cabin crews and passengers. Therefore, they are at high risk level in terms of contagious diseases and infections carried by passengers. Moreover, disruption of circadian rhythm due to working at night and flying to countries in different time zones weaken immune system.

Moreover, the t-test results on the negative effects of working conditions on immune system shows a significant difference at the 90% confidence interval ($p=0.062$ $df_{150}<0.05$) with the marital status of the flight attendants. This finding indicates that their immune system of married flight attendants is negatively affected by working conditions more than single ones. This result supports our eighth hypothesis ($H_{8.6}$). The effect of working conditions on the immune system differs according to marital status. One plausible reason is that married flight attendants could not rest enough in the off-days because they have so much responsibilities in their social life. To avoid the weak immune system, married flight attendants should find ways to balance their work and social life and take time to recover in their off-days to be physically ready for hard working conditions.

5.2.4. Education Level

We measure the education level results by using ANOVA test. Table 5.23 shows the findings. We detect no significant difference between education level and the questions related to sleep and fatigue.

Table 5.23. ANOVA test Results for Education Level

Questions	Education Level	N	Mean	Standard Deviation	df	t	P
On your days off duty, what is the total amount of sleep you get on average?	High School	4	3.75	0.500	4 147	1.286	0.278
	College Degree	25	3.32	0.557			
	Undergraduate Degree	97	3.37	0.666			
	Master degree	25	3.60	0.577			
	Doctorate Degree	1	4.00	0.00			
How many hours of sleep you get on average before night time flights?	High School	4	1.75	0.957	4 147	0.790	0.533
	College Degree	25	1.68	1.030			
	Undergraduate Degree	97	1.68	0.974			
	Master degree	25	2.04	1.136			
	Doctorate Degree	1	1.00	0.00			

Table 5.23. (cont.)

How often do you have troubles to fall asleep before flight duty?	High School	4	1.75	0.957	4 147	0.684	0.604
	College Degree	25	1.88	0.726			
	Undergraduate Degree	97	2.12	0.781			
	Master degree	25	2.08	0.702			
	Doctorate Degree	1	2.00	0.00			
How often do you find it difficult to balance your work and social life?	High School	4	2.75	0.500	4 147	0.528	0.715
	College Degree	25	2.56	0.583			
	Undergraduate Degree	97	2.47	0.694			
	Master degree	25	2.60	0.500			
	Doctorate Degree	1	2.00	0.00			
At the end of your duty, which physical symptom do you feel the most?	High School	4	1.25	0.500	4 147	0.494	0.740
	College Degree	25	1.72	1.137			
	Undergraduate Degree	97	1.94	1.257			
	Master degree	25	2.00	1.155			
	Doctorate Degree	1	2.00	0.00			
Do you think that your immune system is affected negatively due to working conditions?	High School	4	1.25	0.500	4 147	1.599	0.178
	College Degree	25	1.72	1.137			
	Undergraduate Degree	97	1.94	1.257			
	Master degree	25	2.00	1.155			
	Doctorate Degree	1	2.00	0.00			

5.2.5. Work Experience

We measure the work experience by using ANOVA test. Table 5.24 shows the results. We find no significant difference between the work experience and the questions related to sleep and fatigue.

Table 5.24. ANOVA test Results for Work Experience Level

Questions	Work Experience	N	Mean	Standard Deviation	Df	t	p
On your days off duty, what is the total amount of sleep you get on average?	<5 years	86	3.34	.644	4 147	1.875	0.118
	5-10 years	47	3.57	.500			
	11-15 years	9	3.56	.527			
	16-20 years	6	3.00	1.095			
	21 years +	4	3.50	1.000			
How many hours of sleep you get on average before night time flights?	<5 years	86	1.64	.969	4 147	1.372	0.247
	5-10 years	47	1.72	.971			
	11-15 years	9	2.11	1.167			
	16-20 years	6	2.17	.983			
	21 years +	4	2.50	1.732			
How often do you have troubles to fall asleep before flight duty?	<5 years	86	2.02	.719	4 147	0.432	0.785
	5-10 years	47	2.13	.850			
	11-15 years	9	2.22	.833			
	16-20 years	6	2.17	.753			
	21 years +	4	1.75	.500			
How often do you find it difficult to balance your work and social life?	<5 years	86	2.52	.608	4 147	1.181	0.322
	5-10 years	47	2.53	.687			
	11-15 years	9	2.22	.441			
	16-20 years	6	2.33	.816			
	21 years +	4	3.00	.816			
At the end of your duty, which physical symptom do you feel the most?	<5 years	86	1.93	1.281	4 147	0.148	0.964
	5-10 years	47	1.89	1.108			
	11-15 years	9	1.78	1.302			
	16-20 years	6	1.83	1.169			
	21 years +	4	1.50	.577			

Table 5.24. (cont.)

Do you think that your immune system is affected negatively due to working conditions?	<5 years	86	1.26	.439	4 147	0.810	0.521
	5-10 years	47	1.15	.360			
	11-15 years	9	1.22	.441			
	16-20 years	6	1.17	.408			
	21 years +	4	1.00	.000			

5.2.6. Job Position

We measure job position results by using ANOVA test. Table 5.25 shows the findings. According to the test results, there is a significant difference between the job position and sleep time before night flight duty ($p=0.028$ $df_{2\text{-}149}<0.05$) at the 95% confidence interval. The average sleep time of cabin chiefs before night flight duty is higher than the average of pursers. This finding supports our second hypothesis ($H_{2.4}$). The sleep duration before night flight tasks differs according to job position. Cabin crews and pursers have different tasks and go different type of flight duties. Pursers always work in wide-body aircrafts and become like a manager of all other cabin crews and cabin chiefs. Since wide-body aircrafts usually fly to distant destinations in different time zones, the average sleep time of pursers before night flights could be less than cabin chiefs and cabin crews.

5.2.7. Sleep Quality

We measure sleep quality by employing ANOVA test. Table 5.26 shows the findings. According to the test results, there is a significant difference between the sleep quality and the finding related to trouble to fall asleep before night flight duty ($p=0.006$ df df4-147<0.05) at the 95% confidence interval. This result indicates that flight attendants whose sleep quality is good have less troubles to fall asleep before flight duty than flight attendants whose sleep quality is bad. This finding supports our fourth hypothesis (H_4). Difficulty in falling asleep before flight mission differs according to the sleep quality. This finding shows that flight attendants who have troubles to fall asleep before flight duty are aware that their sleep cycle is disrupted, and their sleep quality is affected negatively.

Table 5.25. ANOVA test Results for Job Position

Questions	Job Position	N	Mean	Standard Deviation	df	t	P
On your days off duty, what is the total amount of sleep you get on average?	Cabin Crew	15	3.75	0.488	2	1.320	0.270
	Cabin Chief	129	3.32	0.641			
	Purser	8	4.00	0.744	149		
How many hours of sleep you get on average before night time flights?	Cabin Crew	15	1.75	1.060	2	3.666	**0.028***
	Cabin Chief	129	1.68	0.955			
	Purser	8	1.00	1.408	149		
How often do you have troubles to fall asleep before flight duty?	Cabin Crew	15	1.75	0.743	2	0.097	0.908
	Cabin Chief	129	1.88	0.774			
	Purser	8	2.00	0.641	149		
How often do you find it difficult to balance your work and social life?	Cabin Crew	15	2.75	0.488	2	1.889	0.155
	Cabin Chief	129	2.56	0.651			
	Purser	8	2.00	0.641	149		
At the end of your duty, which physical symptom do you feel the most?	Cabin Crew	15	1.25	1.424	2	0.919	0.401
	Cabin Chief	129	1.72	1.203			
	Purser	8	2	0.535	149		

Table 5.25. (cont.)

Do you think that your immune system is affected negatively due to working conditions?	Cabin Crew	15	1.25	0.488	2 149	1.754	0.177
	Cabin Chief	129	1.72	0.408			
	Purser	8	2.00	0.000			

Table 5.26. ANOVA test Results for Sleep Quality

Questions	Sleep Quality	N	Mean	Standard Deviation	df	t	p
How often do you have troubles to fall asleep before flight duty?	Very good	7	2.57	1.134	4 147	3.811	**0.006**
	Good	36	2.36	0.683			
	Fair	81	2.00	0.689			
	Poor	26	1.77	0.815			
	Very poor	2	1.50	0.707			
Have you ever unintentionally slept during flight (“nodded off)?	Very good	7	1.14	0.378	4 147	1.700	0.153
	Good	36	1.25	0.439			
	Fair	81	1.37	0.486			
	Poor	26	1.15	0.368			
	Very poor	2	1.00	0.000			

5.3. Overall Evaluation

Table 5.27 shows the summary of the results. Among the hypotheses developed in Chapter III, the hypotheses $H_{2.1}$, $H_{2.4}$, H_4, $H_{6.2}$, $H_{6.6}$, and $H_{8.6}$ are supported. However, we find no support for some other hypotheses (H_1, H_3, H_5, H_7, H_9).

The fact that hypothesis 1 (H_1) is not supported shows that all demographic groups whether female or male, young or old have similar sleep habits in their off-days. Although hypothesis 2 (H_2) is supported, we did not get a significant result for hypothesis 3. If there is a significant difference in sleep duration before night flight duties, it is expected that some significant difference occurs in the difficulty to fall asleep before flight duties. However, besides night flight duties, the flights are planned to different hours of day and early evenings. Thus, flight attendants may not think that they have difficulty to fall asleep before each flight duty. This may be the reason for the different support level for these two hypotheses.

Table 5.27. Summary of the Tests Results for the Hypotheses

Hypothesis Number	Hypothesis	Support Level
H_1	Sleep duration on non-working days differs according to demographic characteristics.	Not Supported
H_2	Sleep duration before night flight tasks differs according to demographic characteristics.	Supported
H_3	Difficulty in falling asleep differs according to demographic characteristics.	Not Supported
H_4	Difficulty in falling asleep before flight mission differs according to the sleep quality.	Supported
H_5	Napping during flight mission differs according to the sleep quality.	Not Supported
H_6	The difficulty of balancing work and social life differs according to demographic attributes.	Supported
H_7	Physical pain felt at the end of a flight differs according to demographic characteristics.	Not Supported
H_8	The effect of working conditions on immune system differs according to demographic characteristics.	Supported
H_9	The perception of benefit from fatigue management training differs according to the course type.	Not Supported

In the survey, we asked to participants “Have you ever unintentionally slept during flight (“nodded off)?”, and the answers were two dimensional (Yes or No). Majority of the participants (78 percent) stated that they have unintentionally slept during flight. The findings indicate that there is no significant difference between “unintentionally sleeping during flight” and “the sleep quality”. Although Hypothesis 5, “Napping during flight mission differs according to the sleep quality”, was not supported, it shows us that flight attendants whether their sleep quality is good or bad have nodded off due to working conditions. In this sense, extreme fatigue can cause such cases, like unintentionally sleeping during flight, to happen even if the sleep quality is good.

We find no significant results for Hypothesis 7. This result is surprising. We expected that there might be some differences especially for gender and age variables since physiologic anatomy of men and women are quite different, and there is physical difference between young and old people. However, Table 5.12. shows that 49.3% of the flight attendants feel back pain and 33.6% of them feel foot pain as the most felt physical symptom after flights. This finding indicates that regardless of demographic characteristics, all participants feel job related symptoms after flight duty.

Finally, we asked participants to choose the type of fatigue management training they took from their company. Table 5.28 and Figure 5.10 shows the results. 91.4% of the participants took online training. Since the ratio of participants who took other course types is very low (8.6%), it is obvious that a meaningful difference could not be derived from our sample. Thus, we found no supporting evidence.

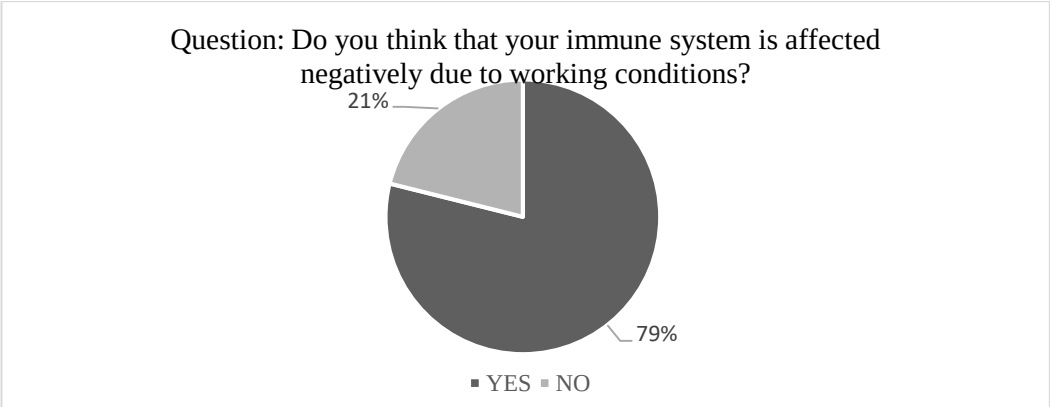

Figure 5.9. Impacts of Working Conditions on Immune System

Table 5.28. The Perception of Benefit from Different Types of Fatigue Training

Question	Course Type	N	Mean	Standard Deviation	Df	T	P
The perception of benefit from fatigue training	Online Training	141	2.68	0.95	149	-0.384	0.138
	In-class Teaching	10	2.80	0.78			

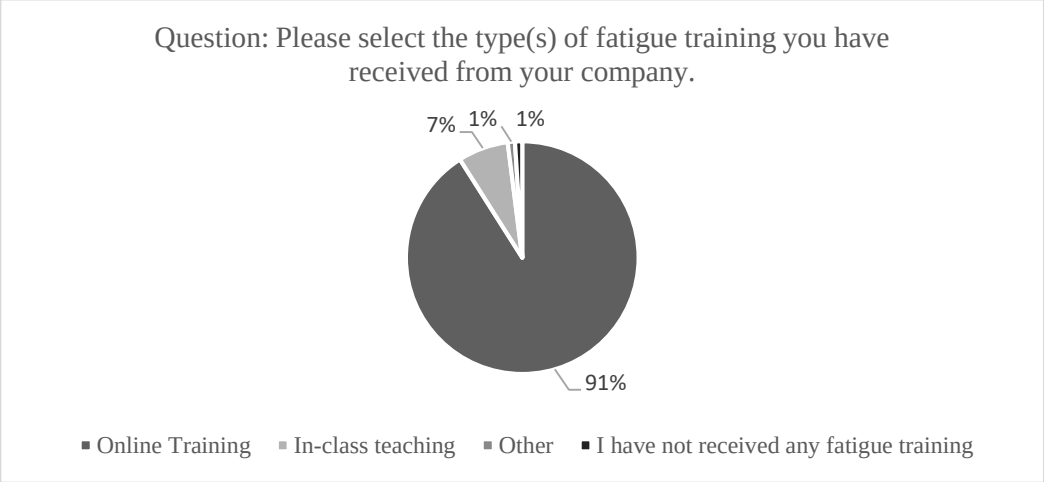

Figure 5.10. Type of Fatigue Training Received from Airline Companies

CHAPTER VI

CONCLUSIONS AND DISCUSSIONS

Aviation industry has shown a remarkable growth over the last decades, leading to an increase in daily airline operations. In parallel to this progress, fatigue has become a serious concern that threatens job performance and wellbeing of employees, including pilots and flight attendants. Although there are many studies focusing on fatigue experienced by pilots, there are relatively few studies investigating the influence of fatigue on flight attendants. Flight attendants belong to a significant occupational group in terms of several duties they perform, and they are exposed to physically demanding working conditions. They do not only provide service to passengers but also, they perform tasks related to safety and security during flight operations. Thus, fatigue acts as a factor that impacts safety and security of flight operations and employee health of flight attendants.

This study examines the symptoms, causes and effects of fatigue on flight attendants. Drawing to the fact that similar studies based on surveys, questionnaires or focus group discussions usually give more measurable results (e.g., Avers et al., 2019; Banks et al., 2012; Chung et al., 2009; Ono et al., 1991; Van Den Berg et al. 2019), we used survey methodology to measure the effect of fatigue on flight attendants. The survey consisted of 32 questions, and all questions were categorized into three sections; demographics, sleep quality and fatigue based on previous studies (Rosekind et al., 2000; Wollmuth, 2017). The survey was available for a period of 60 days from December 1, 2020, to February 1, 2021, and primary data was collected from 152 flight attendants through Google Forms with anonymous participation.

In terms of demographics, the flight attendants that participated to the survey were relatively young, mostly aged between 25-30. Majority of them were female and currently working as cabin crew. To make meaningful evaluations on fatigue, we primarily examined sleep habits of the participants. The results show that more than half of the participants sleep less than 4 or 6 hours when they are at layover with

minimum rest time. Moreover, despite to the fact that airline companies suggest flight attendants to sleep minimum 8 hours before flights, 60 percent of them sleep less than 4 hours before night flight duties. In line with these results, almost all participants declared that they have troubles to fall asleep before flight duty. The findings clearly demonstrate that flight attendants are constantly exposed to sleep deprivation due to irregular working hours. In addition, over 70 percent of the flight attendants stated they have unwillingly slept during the flight. This is important since insufficient sleep may cause human error-based accidents that may endanger flight safety. Therefore, it is not surprising to find out that the flight attendants mostly selected tiredness, concentration, alertness, and errors as the impacts of fatigue in our survey.

The results also show that majority of the participants (87.5 percent) do not want to fly due to fatigue. This finding indicates how common is fatigue among flight attendants. In terms of physical symptoms, the flight attendants are affected from job related physical pains. Majority of the participants suffer from back and foot pain at the end of the flight. Besides physical symptoms, the flight attendants feel emotional exhaustion at different frequencies. These results indicate that physical pain due to working conditions, emotional exhaustion and intense interpersonal relationship with customers increase the occurrence of fatigue for flight attendants.

The results for demographic characteristics also produced meaningful results. Young flight attendants have more difficulty to fall asleep before night flights than their elder colleagues. This finding indicates that flight attendants adopt to their profession as they gain more experience. Hence, it is expected that fatigue occurs more commonly among young cabin crews. In balancing work and social life, we identified that male cabin crews have more difficulty than female flight attendants. Although this finding is surprising, it supports the idea of changing roles of gender in the society. In recent decades, men have more active role in family affairs and women more actively participate to work life than before. Additionally, the results show that married flight attendants have more difficulty in balancing work and social life. This finding is obvious because the schedule of flight attendants is irregular in airline industry that relies on 24-hour operations. Thus, balancing social life while having household responsibilities is more challenging for married flight attendants. Majority of married flight attendants also stated that their immune system is negatively affected by working

conditions. This finding shows that difficulties in balancing work and social life and effects of physically demanding working conditions negatively affect the immune system. Remarkably, 80 percent of the flight attendants stated that their immune system is negatively affected by working conditions. This finding should be seriously taken into consideration by airline companies.

Furthermore, as mentioned in previous studies (Rosekind, 2000; Wollmuth, 2017), fatigue and sleep habits are highly correlated. Therefore, we asked several questions to measure the sleep quality of flight attendants. The results show that difficulty to fall asleep before flight duty differs according to sleep quality. Cabin crews whose sleep quality is good more easily fall asleep before flight than cabin crews whose sleep quality is bad. However, regardless of how flight attendants assess their sleep quality, over 70 percent of the participants have unwillingly slept during the flight. Given the fact that flight attendants carry out significant duties that are subject to security and safety, nodding off due to exhaustion and fatigue should be treated with special care by airline companies.

6.1. Implications of the Study

In civil aviation, fatigue has become a serious issue that threatens the safety of airline operations. Therefore, the causes of fatigue for flight attendants should be seriously taken into consideration by airline companies. The top five most selected factors that cause fatigue by flight attendants were minimum rest time layovers, long duty days, night flights, consecutive days of working and 4 legs flight duty. All these factors are related to scheduling. To mitigate the effects of fatigue, airline companies should revise the scheduling practices. Current international prescriptive rules only comprise the maximum hours of work and minimum hours of rest to control the level of fatigue (Banks et al., 2009). However, as our findings indicate, there are other significant causes that change the level of fatigue. Current international prescriptive rules on fatigue management does not consider 24 hours operations, crossing multiple time zones, recovery and layover time, time of day, and circadian rhythms. For the airline companies to change the scheduling practices, policy makers should follow a more comprehensive approach for fatigue management by imposing additional international rules that help manage the factors that cause fatigue. Airline companies should also

improve the scheduling and rest time and reduce consecutive days of working to reduce fatigue in civil aviation operations.

6.2. Limitations of the Study and Future Research

We acknowledge that this study has some limitations. We collect the data at a certain point of time, i.e., during the COVID-19 pandemic. Although we asked participants to consider the working conditions before the pandemic in the introduction section of the survey to protect the general validity of the results, their answers might be affected from the psychological environment of COVID-19 pandemic. In addition, COVID-19 crisis has made it difficult to reach the participants. Out of 300 potential respondents that were contacted, only 152 of them responded to online questionnaire. This low response rate is a limitation since small sample size can be less effective to produce meaningful results than large sample size. Finally, we collected primary data directly from flight attendants. It is possible that there might be some self-reported biases due to the individual differences. For instance, the flight attendants may over or underestimate the impacts of fatigue or may forget some incidents because of selective memory. Thus, such perception differences might have affected the results.

The effects and causes of fatigue on flight attendants with the awareness of security threats and occupational health risks need further elaboration. Future research may extend the scope by using larger samples and consider the influence of changing working conditions during COVID-19 pandemic. Future studies should also discuss countermeasures and give further suggestions to policymakers to better manage fatigue. Finally, our study used a single location, namely Istanbul, and a single airline company, to collect the data. Future studies may apply the same survey in different locations and to several airline companies to validate the findings of this study.

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APPENDIXES

APPENDIX A SURVEY

CAUSES AND EFFECTS OF FATIGUE AMONG FLIGHT ATTENDANTS

INTRODUCTION

This survey study was prepared for the thesis project by Gözde Erbudak, a student of the Air Transport Management Graduate Program, jointly organized by Turkish Airlines Aviation Academy and Ibn Haldun University (IHU). The purpose of this survey is to analyze the causes and effects of physical and mental burnout experienced by flight attendants. The results of this survey will be a reference to academic studies in the literature in the context of fatigue experienced by flight attendants.

The results of the research will be used only for scientific studies and no personal information is requested except general demographic information. **Participation is anonymous**. In order to prevent the changing working conditions during pandemic from affecting the general validity of the study, **normal working conditions before the pandemic process should be taken into consideration while answering the questions.** The questionnaire consists of 29 multiple choice questions, thank you for your participation.

SECTION I: DEMOGRAPHIC QUESTIONS

1. **Age**
    - 18-24
    - 25-30
    - 31-35
    - 36-40
    - 41 +

2. **Gender**
    - Female
    - Male

3. **Education level**
    - High School Degree
    - College Degree
    - Undergraduate Degree
    - Doctorate Degree

4. **Job position**
    - Cabin Crew
    - Cabin Chief
    - Purser

5. **Experience**
    - <5 years
    - 5-10 years
    - 11-15 years
    - 16-20 years
    - 21 years and above

6. **Marital Status**
    - Married
    - Single

SECTION II: SLEEP QUESTIONS

1. **On your days off duty, what is the total amount of sleep you get on average?**
    - Less than 4
    - 4-6
    - 6-8
    - More than 8

2. **When you are at layover with minimum rest time (12 hours or less), how many hours of sleep do you usually get?**
    - Less than 4
    - 4-6
    - 6-8
    - More than 8

3. **How many hours of sleep you get on average before night time flights?**
    - Less than 4
    - 4-6
    - 6-8
    - More than 8

4. **How often do you have troubles to fall asleep before flight duty?**
    - Always
    - Usually
    - Sometimes
    - Never

5. **Do you think that you get enough sleep before night time or early morning flights?**
    - Always
    - Usually
    - Sometimes
    - Never

6. **How often do you use over-the-counter or prescription medication, or a supplement to help you fall asleep?**
    - Very often / 5-7 times per week
    - Often / 1-4 times per week
    - Sometimes / 1-3 times per month
    - Rarely / 1-10 times per year
    - Never

7. **In general, how do you evaluate your sleep quality?**
    - o Very good
    - o Good
    - o Fair
    - o Poor
    - o Very poor

SECTION III: FATIGUE QUESTIONS

1. **In your opinion, please choose the factors that cause fatigue in civil aviation operations.**
    - □ Long duty day
    - □ 4 legs flight duty
    - □ Night flights
    - □ Early morning departures
    - □ Minimum rest time layovers
    - □ Heavy workload
    - □ Consecutive days of working
    - □ Innutritious meals
    - □ No or few breaks
    - □ Cabin temperature
2. **In your opinion, to what extent is fatigue a concern in civil aviation operations?**
    - o Serious
    - o Moderate
    - o Minor
    - o Not at all
3. **When fatigue occurs, how significant a safety issue is it?**
    - o Serious
    - o Moderate
    - o Minor
    - o Not at all
4. **In which of the following ways does fatigue affect your performance? (select all that apply)**
    - □ Alertness/attention
    - □ Omissions
    - □ Apathy

- Judgement
- Slow reaction
- Errors
- Concentration
- Motor skills
- Mood change
- Tired/Sleepy
- Memory
- Crew resource management skills

5. **In your opinion, which phase of flight is the most affected by fatigue?**
    - Taxi
    - Take off
    - Cruise
    - Descent
    - Landing

6. **How often do you find it difficult to balance your work and social life??**
    - Always
    - Usually
    - Sometimes
    - Never

7. **Which type of flight duty does make you more exhausted?**
    - Domestic flights
    - Short or medium-haul international flights
    - Long-haul (ER) international flights

8. **Which strategies do you use to manage fatigue prior to a flight?(Select all that apply)**
    - Drink plenty of water
    - Take a shower
    - Drink coffee
    - Exercise
    - Take naps
    - Take vitamins
    - Use drugs

9. **Which strategies do you use to manage fatigue after a flight? (Select all that apply)**
    - Drink plenty of water
    - Take a shower

- Drink coffee
- Exercise
- Take naps
- Take vitamins
- Use drugs
- Drink alcohol

10. In your opinion, which changes could be done in order to reduce fatigue in civil aviation operations? (Select all that apply)

- Duty time limits
- Improve scheduling
- Improve rest time
- Improve days off
- Train management and crew planning department about fatigue
- More effective training about fatigue to crew-members
- Augment crews
- Limit early departure flights
- Limit late night flights
- Reduce consecutive days
- Increase company support
- Opportunity to switch duties between crew members

11. Have you ever unintentionally slept during flight (“nodded off)?

- Yes
- No

12. Have you ever do not want to fly because of fatigue?

- Yes
- No

13. At the end of your duty, which physical symptom do you feel the most?

- Back pain
- Foot pain
- Shoulder/elbow/wrist/hand pain
- Joint pain
- None of them

14. Do you think that your immune system is affected negatively due to working conditions?

- Yes
- No

15. When you are having a bad day, is it hard for you that you have to smile to passengers most of the time?

- Always
- Usually
- Rarely
- Never

16. How often do you feel apathy or emotional exhaustion?

- Usually
- Sometimes
- Rarely
- Never

17. To what extent, does your company shows concern for employees' overall health?

- To a great extent
- To a moderate extent
- To a minimum level
- Not at all

18. Please select the type(s) of fatigue training you have received from your company.

- Online training
- In-class teaching
- Other
- I have not received any fatigue training

19. Do you think that the fatigue training program that you have received was helpful?

- Very helpful
- Moderately helpful
- Slightly helpful
- Not helpful

CURRICULUM VITAE

Personal Information:

Name Surname: Gözde ERBUDAK

Education:

2019 – 2021	Ibn Haldun University, MSc in Air Transport Management
2013 – 2018	Özyeğin University, International Relations Department

Experience:

December 2021	Corporate Sustainability Management | Specialist in Turkish Airlines
November 2020	Quality and Process Development Management | Specialist in Turkish Airlines
January 2019	Flight Attendant at Turkish Airlines