UNIVERSITI PUTRA MALAYSIA

PREVALENCE OF SOLAR UV-PROVOKED ANTERIOR SEGMENT EYE DISEASES AND ASSOCIATION OF RISK FACTORS AMONG FISHERMEN IN JAZAN, SAUDI ARABIA

AHMED I. A. ALIBRAHIM

FPSK(P) 2017 1

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By

AHMED I. A. ALIBRAHIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Doctor of Philosophy

PREVALENCE OF SOLAR UV-PROVOKED ANTERIOR SEGMENT EYE DISEASES AND ASSOCIATION OF RISK FACTORS AMONG FISHERMEN IN JAZAN, SAUDI ARABIA

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January 2017

Chairman : Assoc. Prof. Shamsul Bahri Hj Mohd Tamrin, PhD
Faculty : Medicine and Health Sciences

Excessive exposure to ultraviolet (UV) radiation poses a serious threat to human health and safety especially among the outdoor workers. It can cause various types of eye disease such as cataract, pterygium, photoconjunctivitis, photokeratitis and pinguecula. Thus, this study was conducted with the aim to investigate the prevalence of solar UV provoked anterior eye segment diseases and the associated risk factors among on fishermen of Jazan. This cross-sectional study was conducted among fishermen in five ports of coastal areas in Jazan in Saudi Arabia. A questionnaire was used to determine the socio demography and occupational information of the fishermen. An eye examination was conducted for all of the respondents. The results obtained from this study discovered a significant association between working experiences with some of the UV-related anterior segment eye diseases ($p > 0.05$). Moreover, this study found that days of work per week gave a significant influence to the eyelid in the right and left eye as well as overall eyelid diseases ($p < 0.05$). Besides, number of working hours per day was also recorded to have a significant association with conjunctival lesion/mass in the left eye and overall conjunctival mass since the p values are less than 0.05. Similarly, the place of resting, time of work, the use of hat outdoors, knowledge on UV, use of sunglasses and types of uniform during fishing have also demonstrated an association with a number of UV-related anterior segment eye disorders as their p values are less than 0.05. However, based on the multiple logistic regression analysis, the results is corresponding with previous studies where the risk of overall eye diseases significantly increases by 1.76 times for those who have worked for more than 10 years as fisherman compared to those who have worked less than 10 years.

Keywords: UV-related anterior segment eye diseases, Fishermen, Jazan, pterygium, pingueculae, cataract.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

PREVALENS PENYAKIT MATA SEGMEN ANTERIOR CETUSAN UV SOLAR DAN HUBUNGKAITNYA DENGAN FAKTOR RISIKO DI KAWASAN JAZAN, SAUDI ARABIA

Oleh

AHMED I. A. ALIBRAHIM

Januari 2017

Pengerusi : Prof. Madya. Shamsul Bahri Hj Mohd Tamrin, PhD
Fakulti : Perubatan dan Sains Kesihatan

Pendedahan berlebihan kepada sinaran ultraungu (UV) merupakan ancaman serius kepada kesihatan dan keselamatan manusia terutama di kalangan pekerja yang bekerja di tempat terbuka. Secara khususnya, ia boleh menyebabkan pelbagai jenis penyakit mata seperti katarak, pterygium, photoconjunctivitis, photokeratitis dan Pinguecula. Oleh itu, kajian ini dijalankan dengan tujuan untuk menyiasat prevalens penyakit mata segmen anterior cetusan UV solar dan hubungkaitnya dengan faktor risiko di kalangan nelayan kawasan Jazan, Saudi Arabia. Kajian keratin rentas ini telah dijalankan di Lima pelabuhan kawasan pantai di Jazan di Arab Saudi. Borang soal selidik telah digunakan untuk menentukan sosio-demografi dan maklumat pekerjaan nelayan. Pemeriksaan mata telah dijalankan untuk semua responden. Keputusan yang diperolehi daripada kajian ini mendapati hubungan yang signifikan di antara pengalaman bekerja dengan beberapa penyakit mata segmen anterior yang berkaitan dengan UV ($p > 0.05$). Selain itu, kajian ini juga mendapati bahawa hari kerja seminggu memberi pengaruh yang besar untuk kelopak mata di sebelah kanan dan kiri mata serta penyakit keseluruhan kelopak mata ($p < 0.05$). Bilangan jam kerja dalam sehari juga memberikan hubungan yang signifikan dengan konjunktiva di mata kiri dan jisim konjunktiva keseluruhan berdasarkan nilai p yang kurang daripada 0.05. Begitu juga, tempat berehat, masa kerja, penggunaan topi di luar rumah, pengetahuan mengenai UV, penggunaan cermin mata hitam dan jenis pakaian seragam semasa memancing juga menunjukkan hubungkait dengan beberapa gangguan segmen anterior mata yang berkaitan dengan UV. Walaubagaimanapun, berdasarkan analisis regresi logistik, keputusan kajian ini mempunyai persamaan dengan kajian sebelum ini di mana risiko keseluruhan penyakit mata meningkat sebanyak 1.76 kali bagi mereka yang telah bekerja selama lebih daripada 10 tahun sebagai nelayan berbanding dengan mereka yang bekerja kurang daripada 10 tahun.

Kata Kunci: Penyakit mata segmen anterior berkaitan UV, Nelayan, Jazan, pterygium, pinguecula, katarak.

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My thanks are also to everyone who might have supported me in a way or another whom I may have forgotten.

I certify that a Thesis Examination Committee has met on 12 January 2017 to conduct the final examination of Ahmed I. A. Alibrahim on his thesis entitled "Prevalence of Solar UV-Provoked Anterior Segment Eye Diseases and Association of Risk Factors among Fishermen in Jazan, Saudi Arabia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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This is to confirm that:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ARPANASA	Australian Radiation Protection and Nuclear Safety Agency
AS	Australian Standards
BCC	Basal cell carcinoma
BETT	Birmingham Eye Trauma Terminology
CDK	Climatic droplet keratopathy
CI	Confidence interval
DM	Diabetes mellitus
DR	Diabetic retinopathy
GSS	Go Sun Smart
HBM	Health belief model theory
ICNIRP	International Commission for Non-Ionising Radiation Protection
INAIL	Italian National Institute of Insurance for Occupational Accidents
KAP	Knowledge, attitude and practice
MLR	Multiple logistic regression
MOA	Ministry of Agriculture
MOH	Ministry of Health
MSD	Musculoskeletal disorders
NMSCs	Non-melanoma skin cancers
PD	Pupillary diameter
PPE	Personal protective equipment
PSC	Posterior sub capsular cataract
SCC	Squamous cell carcinoma,
SCT	Social Cognitive Theory
SPF	Sun protection factor
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UV	Ultraviolet
UVI	UV Index
UVR	Ultraviolet Radiation
WHO	World Health Organisation
WMO	World Meteorological Organisation

CHAPTER 1

INTRODUCTION

1.1 Research background

According to the royal decree in 1987, providing comprehensive and high-quality healthcare for fishermen is of great importance to the Saudi government through the Ministry of Agriculture (MOA). This effort includes providing the right environment to them, supporting those who are interested to engage in fishing by supplying fishing boats with soft loans as well as encouraging them to make a living from fishing, which resulted in 450,160 total soft loans (without interest) from 1965 to 2015/2016 with a total value of Saudi Riyal60 billions according to the agricultural development fund in 2016. The government also plays a crucial role in supervising all fishing and diving businesses and organisations in order to help in finding ways for development, investment and protection of living aquatic resources in the regional water of the Kingdom to promote employment within the sector. This is conducted through coordination with the National Commission for Wildlife Conservation and Development, which has ultimately led to the important development and produced vital outcomes based on the royal decree in 1987 by the MOA, such as:

1. Determination of fishing areas in the territorial waters of the Kingdom.
2. Identification of marine tourist sites suitable to establish fish farming projects.
3. Determination of types and varieties of banned aquatic caught once or during specific periods of the year.
4. Identification of means of forbidden fishing methods.
5. Aiding fishermen in enhancing their fishing methods and encourage them to form cooperative assemblies and societies.
6. Obtaining contracts with agreements in the field of water resources development and extraction through live scientific and commercial institutions in accordance with the applicable regulations.
7. Conducting applicable and statistical researches, and other materialistic or theoretical means that may lead to more advantages for the wealth of water live resources.

Apart from the mentioned roles, they also regulated the workers, fishermen and investors to protect the marine environment and prohibit absolute exploitation of the sea, which would ultimately cause a negative impact on the marine environment. According to the statistics report by the MOA in 2013, the total number of fishermen in Jazan region was confirmed to be 5013 (Table 3.1), while the total number of foreign fishermen in Jazan region was 1989 (39.7%). It was noted that the total number of fishermen in Jazan port itself was 2428, whereas the total number of foreign fishermen in the same port was 1235 (50.9%). Most of the local fishermen registered were of old age and had stopped working while they were still in the MOA fishermen registry.

1.1.1 Overview of the eye and UV

Eye is responsible for the admission of visible light which will then processed into nerve impulse before transmitted to the brain. Anatomically, the eyeball, or globe, is located in bony socket with the skull, namely, the orbits. The supraorbital ridge and the eyelids with eyelashes provide additional protection against potential external insult. Nevertheless, such protective features do not entirely protect the eye from UV-intensive sunbeds, intense ground reflection in snow, sand, and water. Innate responses such as pupil constriction, squinting or total eyelid closure can only reduce the intensity/volume of rays that pass through the pupils. Such responses are induced by intense visible light but not UV rays. Even daylight with complete cloud coverage can pose a high UV radiation index. As such, these in-built protective mechanisms need a proper personal protective equipment to protect the eye from UV harm. Figure 1.1 illustrates the types of UV exposure from the sun.

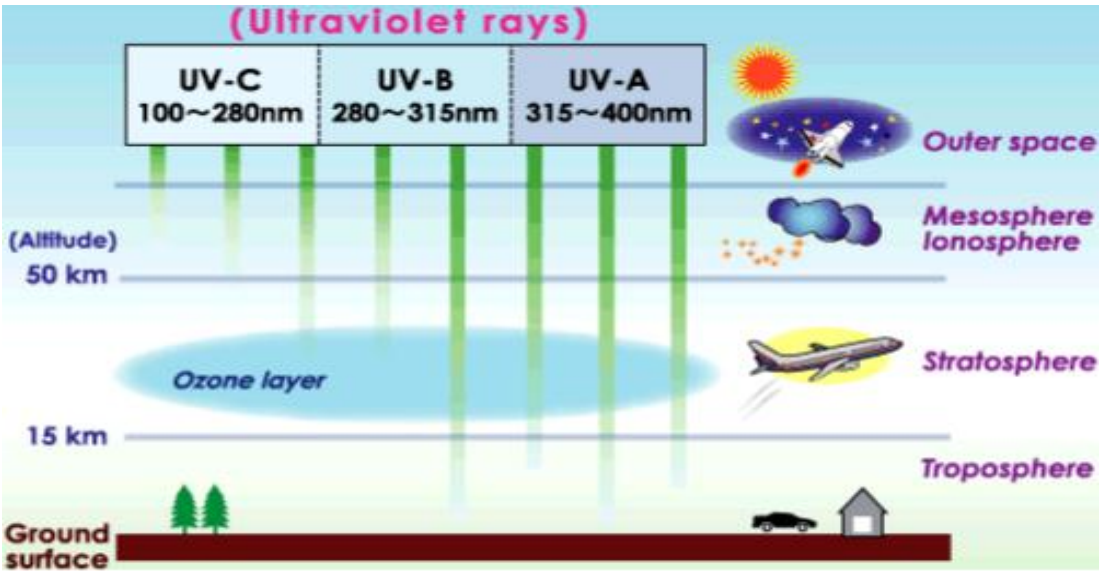

Figure 1.1: The type of UV exposure and how it reached the earth. The figure shows that the 3 types of UV radiation which are UV-A, UV-B and UV-C. UV-C is totally prevented by ozone layer while UV-B partially prevented. However, UV-A is entirely reached the earth.
(Source: www.cger.nies.go.jp/en/)

High exposure to ultraviolet (UV) radiation poses a serious threat to human health and safety. UV radiation destroys living tissue cells by damaging proteins, enzymes and nucleic acids that normally absorb UV radiation and creates free radicals within cells and tissues, which further resulted in an inflammation (Miller et al., 1999). Fishermen, by the nature of their work, spend a long hours at the sea. The solar radiation is hypothesised to affect the eye. Ultra violet radiation (UVR) may be segregated into the following three groups:

1. UV-A (wavelength of wich is 315-400 nm), which completely penetrates the ozone layer and can reach the human eyes
2. UV-B (wavelength of which is 280-315 nm), which partially penetrate the ozone layer and finally
3. UV-C (100-280 nm), which is entirely blocked by the ozone layer.

According to McCarty and Taylor (1999), the main disease resulted from over exposure to the sun and UV is nuclear cataract, which is reported to be ranged between 6-38%. This is a reason why vulnerable persons, workers and professionals have to be protected from the increased level or prolonged exposure of UV radiation to avoid the resultant cataract and other eye diseases.

The cornea and lens play a significant role in the absorption of certain UV wavelength, thus preventing it from reaching the retina. Since the cornea forms the anterior portion of the eyeball, it absorbs most of the UV-B and all of the UV-A, (McCarty and Taylor, 2002).

The UV index (UVI) was jointly devised by numerous bodies such as the WHO (World Health Organisation), the WMO (World Meteorological Organisation), UNEP (United Nations Environment Programme) and the ICNIRP (International Commission for Non-Ionising Radiation Protection) in 1995 to provide a clear scale of reference for UV exposure risks, which was aimed at assessing risks in outdoor sunny condition for the general public. With scores ranging from 0 - 11+ grouped into five categories, people which fall into each categories were given advices on the type of protection recommended (Figure 1.2).

Values from 0 - 2 are considered as little to no UV radiation risk, but the use of sunscreen and sunglasses is still advisable. Meanwhile, the values from 3 - 5 denote a moderate risk in UV exposure. Wearing sunglasses, sunscreen and wide-brimmed hats are imperative. Values ranging from 6 - 7 are considered as the high risk zone; therefore, above precautionary measures are important such as seeking shade, using wide-brimmed hats, sunscreen and sunglasses. Last but not least, the values from 8 - 10 denote a severe hazard risk, while any value exceeding 11 and above is critical, which demands the public to remain indoors.

Figure 1.2: UV index scale and recommendations of protection. Based on the levels of UV index, the proper personal protective equipments (PPE) should be used. The UV index level can be approached to 11 and more whereby the proper PPE is strongly recommended and the five behaviors on sun safe shoud be remembered which are slip, slop, slap, seek, slide.
(Source: www.qld.gov.au)

1.2 Problem statement

Ocular diseases have been reported to affect many people worldwide. It was estimated 80 million people worldwide diagnosed visually impaired or disabled. In fact, this number of patients increases approximately 7 million people per year. In United States alone, about 3.4 million people over the age of 40 are blind or visually impaired (Resnikoff et al. 2004; Congdon et al. 2004).

There are various ocular diseases that can lead to blindness, some of which can be prevented or reversed if correctly managed. Cataract is the predominant cause of blindness across the globe as reported by recent assessments. Cataract and glaucoma are responsible for 51% and 8% of blindness worldwide, while uncorrected refractive errors and cataract are responsible for 42% and 33% of the visual impairment in the world (Pascolini and Mariotti, 2012) (Figure 1.3).

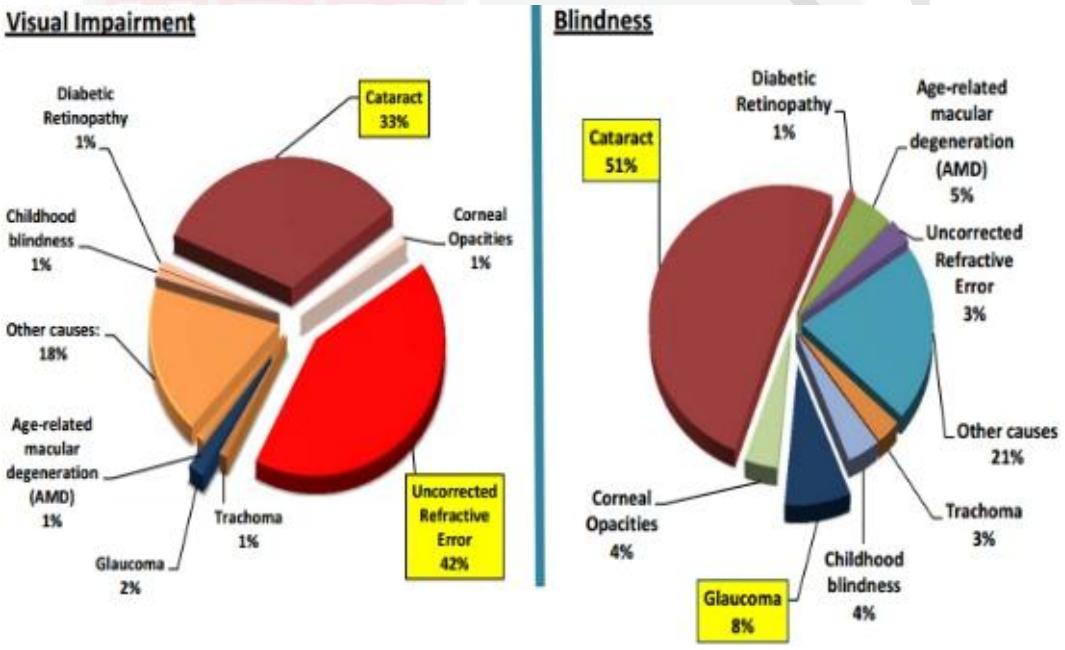

Figure 1.3: The causes of the blindness and visual impairment worldwide. The main cause of blindness world wide is cataract by 51% followed by glaucoma by 8%. Wheras the main cause of viual impairement is uncorrected refractive error.
(Source: Pascolini and Mariotti, 2012)

In region of Jazan, fishing is a major contributor of the economy (Alwatan, 2015). The only research reported to date was reported by a group of researchers from the Ministry of Health (MOH) and members of (WHO in 2012), in which studied the correlation of diabetes mellitus (DM) and diabetic retinopathy (DR) in different areas in Jazan such as at the mountains, coastal areas and interior villages. The total number of population in this study was 3,800.

The results showed a poor health status healthcare facility in Jazan and its surrounding districts. The prevalence of cataract among the elders in Jazan (50 years and above) in 2012 was reported to be 2204 (58.6%). This made cataract the major cause of blindness, followed by diabetic retinopathy (DR) with 1436 (37.8%) cases and diabetic maculopathy with 855 (22.5%) (Hajar et al., 2015).

Extended exposure to UV rays could lead to severe health problems, particularly in the immune system, the eyes and skin. For the latter, sunburn is a common problem as described by Lindfors and Vuilleumier (2005). Furthermore, research by Katoh et al. (2001) uncovered the fact that being exposed to direct sunlight for 4 hours or more was likely to increase the risk of cortical cataracts and that indoor professions were associated with less risk than outdoor professions (Neale et al. 2003).

Fishermen in Saudi Arabia including Jazan region are at a 'high risk' because of prolonged exposure to sunlight during peak hours of the day. To date, data regarding the incidence, prevalence and the burden of UV-provoked eye conditions and awareness level of local population in Saudi Arabia are still scanty. To the best of our knowledge, there was no report in Saudi Arabia regarding this issue except from two studies conducted to measure the knowledge, attitude and practice towards skin cancer related UV radiation by Al-Ghamdi et al. (2015) and Al-Amri et al. (2015).

Besides, the studies on eye generally in Jazan are very rare compared to other cities in Saudi Arabia. This might be due to some limitations in conducting such research in Jazan. The main problem lies on the fact that there is no data regarding ways to intervene the effect of UV radiation. However, without a solution to the existing problem, workers' productivity would decline. This would eventually not only affect the workers, but also their families as they would all be burdened. At the end, this would lead to a huge financial loss.

It should be borne in mind that the Saudi government gives compensations to local patients who suffered from chronic diseases such as occupational injuries including eye injuries or diseases. However, it is still unclear whether health insurance scheme is offered to the locals. As a result, the Saudi government will bear the cost of diseases of its population. The amount of health budgets has increased from from 22.8 billion SR in 2007 to 62.3 billion SR in 2015 (MoH, 2015).

The prevalence of cortical cataract had increased in Maryland, which was correlated with sun-exposure index. Ninety-five percent of total population recorded to have cortical cataract and there was a significant association between cataract and UV-B exposure (West al, 1998). Furthermore, countries closer to equator obtained even a higher level of exposure to UV and had high prevalences of pterygium (Sun et al. 2013). Thirteen percent of pterygium cases in rural India among youngsters above 30 years old who spent most day time outdoors (Nangia et al. 2013).

Many studies highlighted the association between the UV and skin disorders; 18 articles of interventional studies have reported skin diseases related to UV exposure around the world (Reinau et al. 2013). There were many researches that investigated the association of diseases such as pterygium, pinguecula, and cataract with the UV but unfortunately none of them were conducted among the fishermen. Four researches, had reported the knowledge level and behaviour of the UV effects on eyes (Graham et al., 1994; Lee et al., 1999; Pakrou et al., 2008 and Oduntan et al., 2009).

Thus, more clinical researches are needed to address the magnitude of such problems and find the solutions, as will be described in Chapter 2. As can be observed in Figure 1.4, too low exposure to UV radiation can cause skeletal diseases, while

frequent exposure to UV rays increases the likelihood of contracting skin cancer, in addition to diseases of the eye. Therefore, a correct balance of UV exposure must be targeted for and obtained.

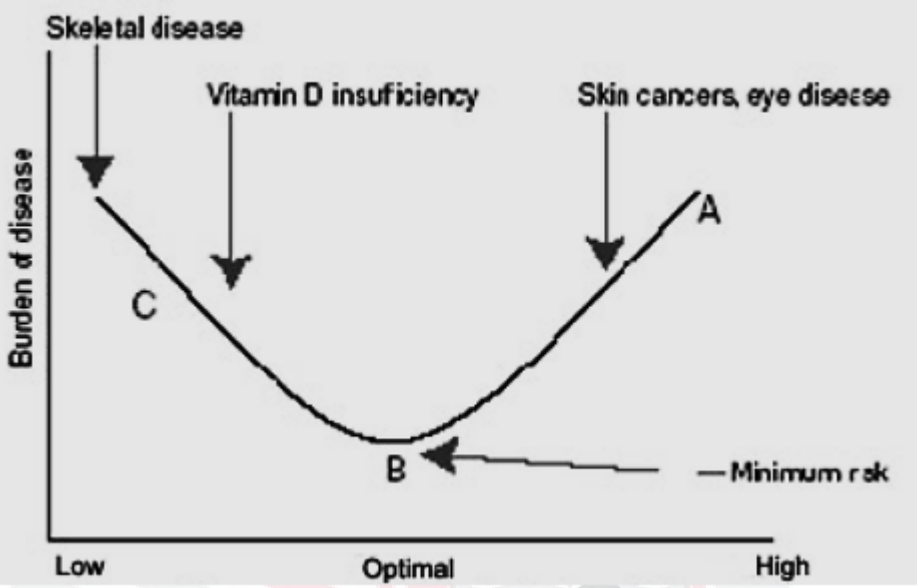

Figure 1.4: Representation of UV exposures vs. relative contractible diseases. Long-term exposure to UV-radiation can cause skin cancer and eye diseases, however the low exposing to UV radiation, the higher propabilty of getting skeletal diseases and vitamin D insufficiency. The minimum risk is to be optimal in exposing to the UV-radiation.
(Source: www.who.int)

This present study undertook preliminary research to ascertain pertinent goals for future studies. This study was conducted with the cooperations from the chief of fishermen, the fishermen themselves, and also the officers' in-charge of giving licenses and permission to the aforementioned party in District Council of Jazan. This preliminary research was aimed to investigate the issues faced by fishermen during work and devise interventional procedures in line with the health belief model theory (HBM). In communication and discussion with the fishermen, the main complains were related strongly with the 'hot weather'. It was also clear that the fishermen were of low education status and had low understandings of the risks and preventative procedures in relation to UV exposures. Table 1.1 further represents the current findings.

This study employed five participants and split them into two groups of three and two, respectively. A qualitative methodology was utilised for these findings. Table 1.1 outlines the observations made in the field alongside the fishermen in sunny conditions. Words and phrases such as 'hot weather', 'fishermen not educated', 'working outdoor' and 'no sunglasses' were frequently used by the fishermen during interviews. Even officers and chiefs appeared to be lacking of knowledge regarding the dangers and precautions surrounding the UV exposure. Therefore, it was imperative that such high risk individuals were in need of assistance.

Table 1.1: Frequency of repeated words during interview

Problems	Frequency
Injuries	3
Hot weather	16
Blurry vision	6
Eye diseases	13
Cataract	1
Fishermen not educated	14
No sunglasses	10
Skin diseases	6
No using long sleeve	3
Need hats	3
Needs intervention	1
Working outdoor	13
Shade	3
Protection	2
Education	6
Sea	8
Investigation	4

Additionally, it became clear through the interviews that majority of the fishermen took no protective/preventative action. It was also found that some boats featured shading, but those are inadequate and seem to be of cheap low-quality shades. Figure 1.5 illustrates the working conditions for the fishermen who were only protected by insufficient shades with no PPE.

Figure 1.5: Low-cost shade on a boat at Jazan port. The low cost shade as well as non-using PPE can cause skin and eye diseases. The figure shows that the fishermen are not aware of the risks of workin directly under the sun.

The UV-Index is relatively unknown to majority of people, even among the highly educated. Within the general authority of meteorology and environmental protection of Saudi Arabia, UV index was generally not regarded as a problem that clearly requires immediate attention, given that temperature in Saudi Arabia was one of the highest in the world. For example, the UVI through out daytime is demonstrated in Figure 1.6 in locations across Saudi Arabia compared to locations across Malaysia (Figure 1.7).

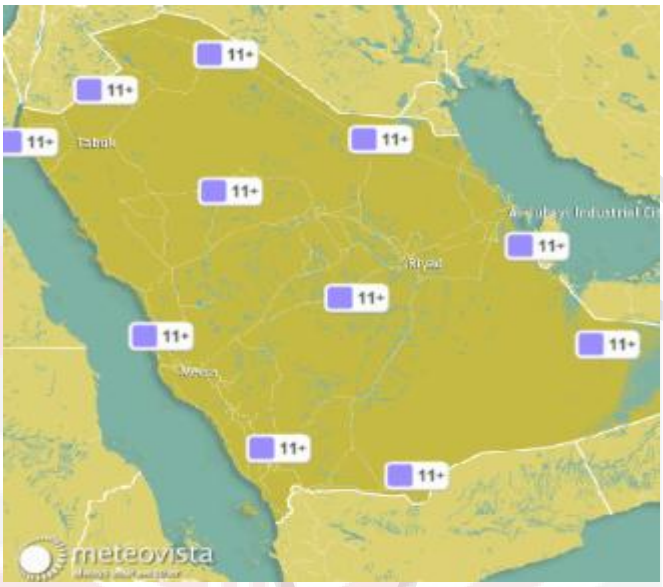

Figure 1.6: The UV index of all locations in Saudi Arabia. The figure shows an extreme UV-index level in most of locations.
(Source: www.meteovista.com)

Figure 1.7: The UV index of the main locations in Malaysia. Which can help the people of which PPE should be used based on the level of the UV-index itself.
(Source: www.meteovista.com)

1.3 Study Justification

Comprehensive data provided by this study wouldoffer objective evidences on the epidemiology of various UV-induced eye diseases which were preventable and assist in devising population- or / region-specific interventional measures.

Improvement in knowledgeand PPEamong the fishermen regarding the danger of the UV, reduction of the healthcare cost and establishment of a database regarding the eye healthcare among fishermen. Relevant and appropriate eye health message to the community, recommending appropriate life style, evaluating the efficacy of routine, and probing conservative sun protective measures to decrease diseases from UV radiation are important part of this study.

It is worth mentioning that Jazan region has a relatively poor status and healthcare facilities and services compared to big cities like Riyadh and Jeddah. Occurrence of UV-related eye diseases among the fishermen in Jazan would potentially exacerbate to the already overwhelming health and would even cost the government an extra budget. It would also cause the fishermen to lose income as they need to travel to big cities for appropriate healthcare providers although the government will compensate their travel tickets as well as their living cost, and treatments. In contrast, if the same eye disorders could be prevented, or health services were made available in cities like Jazan, the loss of income or the high cost of treatment could be inimised.

The burden resulted from UV-related eye disorders are reflected on to the general community and government. This means that lack of awareness on the importance of proper intervention can further weaken productivity. As a result, this would negatively affect governmental incomes and ultimately cause a damaging effect to communities such as peoples will be forced to import/purchase of imported goods that costed them high amounts of money.Besides, this would burden the government further as the need for treatment would cause extra deficit to government's income, knowing that treatment is entirely borne by the government in Saudi Arabia.

In addition, studies on eye and its diseases or injuries in Jazan province are limited. It is even more limited among fishermen in Jazan. Thus, the findings from this study would enhance our understanding and be used to improve the health status of particularly fishermen and those working at the sea, and generally of those who work under the sun as they may suffer serious issues such as skin cancer, ocular cancer and ocular diseases such as cataract, climatick droplet keratopathy, ptyrygium and pingueculae. It is also said that untreated cataract may lead to glaucoma, which is a sight threatening disease.

The main objective of the present study is to determine the prevalence of UV-related anterior eye diseases among fishermen in Jazan. Data collected in this paper may serve as a useful preliminary data for future researches related to UV, particularly in Saudi Arabia.

1.4 Conceptual framework

The structure of this studywas split into two stages; the first stage determined the prevalence of the UV-realted anterior segment diseases while the second stagelinks between dependent/independent variables and measured the associations of the risk factors with the UV-related anterior segment eye diseases,. Since there are many UV-related eye diseases, the pterygium was selected as the example of conceptual framework as well as benchmarked.

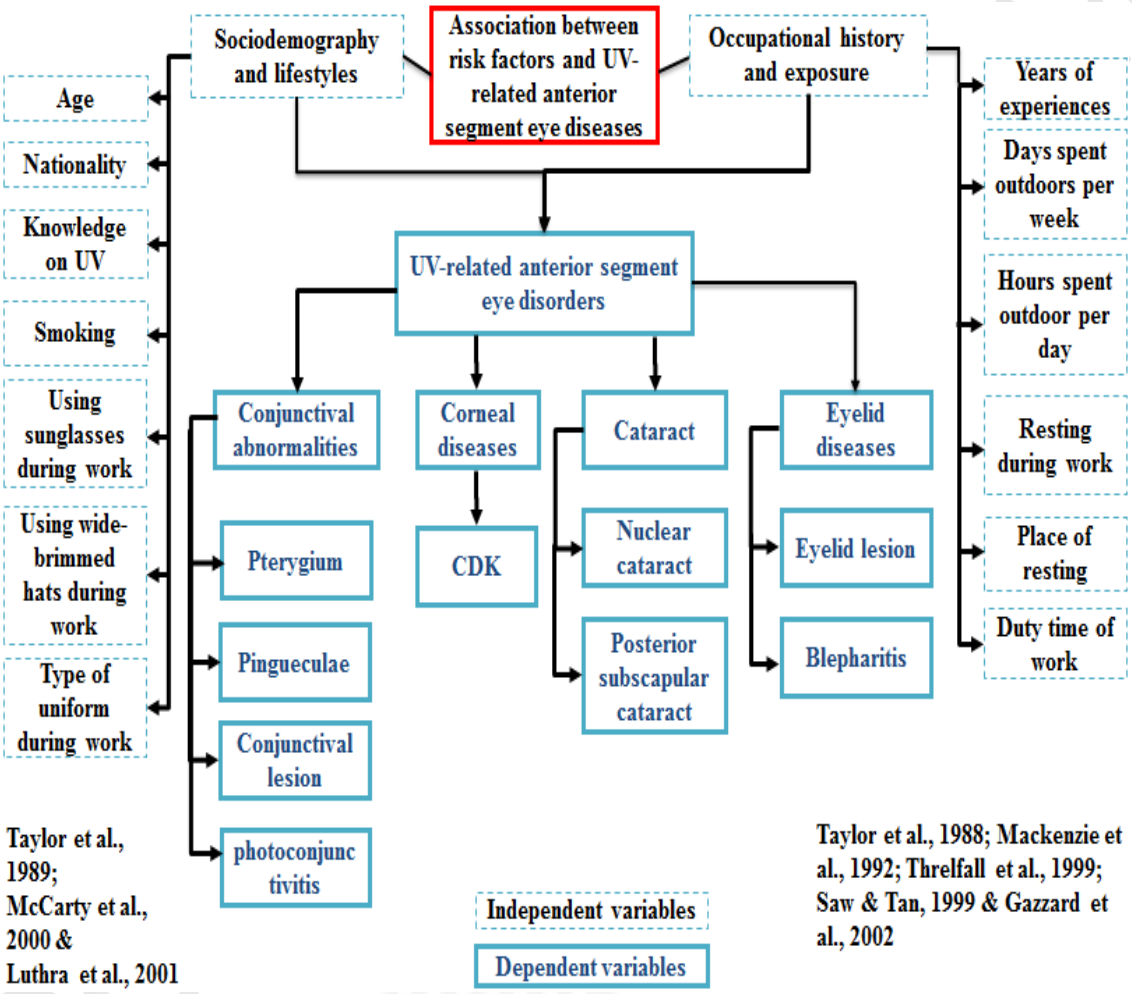

Figure 1.8: The conceptual framework of the current research. The figure shows the independent and dependent variables that have studied in this study.

The figure 1.8 above describes the followings:

1. It describes the conceptual framework of the study wherein the idependent variables are consisting of the followings: Sociodemographic risk factors as well as life styles were measured using questionnaires such as age, nationality, the current knowledge/idea on UV, smoking, the use of personal protection equipment such as sunglasses and wide-brimmed hats, and finally the type of the uniform which are used during working outdoor.

2. Occupational risk factors were also measured using questionnaires such as years of working experiences, days spent outdoors per week, hours spent outdoor per days, frequency of resting during work, the place of resting during working whether indoor or outdoors and finally the duty time of work whether in the day or in the night.

3. As for the dependent variables as shown also in figure 1.8, the all anterior segment eye diseases which related to solar UV radiation such as conjunctival abnormalities (pterygium, pingueculae, conjunctival lesion/mass and photoconjunctivitis), corneal diseases (climatick droplet keratopathy (CDK)), cataract (nuclear and posterior subcabsular cataract) and eyelid diseases (eyelid lesion and blepharitis) were investigated using special medical equipments and a special form as well.

4. The associations between the independent and dependent variables, and the UV-related anterior segment eye diseases were measured using a special statistical analysis.

There is strong evidence stating that risk factors are associated with UV radiation and UV-related eye diseases such as pterygium, pingueculae and cataract (Taylor et al., 1988; Threlfall and English 1999; McCarty et al., 2000; Luthra et al., 2001; and Gazzard et al., 2002). The trend of increasing prevalence with age was found in the Chesapeake Bay research among watermen and the prevalence of pterygium was discovered to be 8.3% in the age of 30 years and above (Taylor et al. 1989).

According to the study done by Saw & Tan (1999), the pterygium is associated with the lack of education where those with less than or equal to 12 years of education are most likely to have pterygium. On the other hand, the study of Chesapeake Bay among watermen by Taylor et al. (1989) has found that watermen with education of more than eight years are most likely to be protected from UV radiation. Meanwhile, the study conducted by McCarty et al. (2000) has discovered less pterygium among smokers.

The most important factor associating the UV radiation and eye diseases is the amount of time spending outdoor (Luthra et al. 2001). This group of researchers has also found that ethnicity can be considered as a risk factor contributing to pterygium, which presents the prevalence of 23.4% among black subjects, followed by 10.2% of white subjects. Mackenzie et al. (1992) have found that the increase in risks appeared on the people who do not use the PPE (sunglasses and wide-brimmed hats).

The baseline knowledge among teenagers on the effects of UV toward the eyes were found similar in both studies carried out by Lee et al. (1999) and Pakrou et al. (2008). Besides, the dark skin on the students presented that they have lesser knowledge compared to other students with different skin types (Pakrou et al. 2008).

There are multiple courses of action that may prevent pterygium, which indicate the crucial nature of educating people. Encouraging the use of preventative and protective elements such as sunglasses and wide-brimmed hats may be crucial to pterygium inhibition in people required to spend prolonged hours outdoors (Saw & Tan, 1999).

1.5 Research Questions

1. What are the prevalences of UV-related anterior segment eye diseases among fishermen in Jazan?

2. What are the associating factors of ocular surface diseases and cataract among fishermen in Jazan?

3. What is the UV-index level of one year in Jazan?

1.6 Objectives

1.6.1 General objective

To determine the association of risk factors with the prevalence of anterior segment eye disorders among the fishermen in Jazan, Saudi Arabia.

1.6.2 Specific objectives

1. To determine the sociodemographic data of the fishermen in Jazan including age, nationality, educational level, marital status, family size, income and smoking status.

2. To determine the occupational data of the fishermen in Jazan, which include the types of fishermen, number of years working as fishermen, number of hours working as fishermen, number of hours spent in the daylight, and the use of protective equipments.

3. To determine the prevalence of UV related anterior segments eye disorders among fishermen in Jazan including pterygium, pinguecula, photokeratitis, photoconjunctivitis, and cataract.

4. To examine the association of sociodemographic and occupational history datas with the prevalence of the UV related anterior segment eye disorders among the fishermen in Jazan using univariate analysis.

5. To examine the relationship of sociodemographic and occupational history datas with the overall UV-related anterior segment eye diseases among fishermen in Jazan using multivariate analysis.
6. To determine the daily UV-index scale of Jazan (the coastal area) for one whole year from 03/01/2015 to 03/01/2016.

1.7 Hypothesis

1. There is significant association between the occupational data and the ultraviolet radiation with the anterior segment eye diseases using univariate analysis.

2. There is significant association between the socio demographic data and the UV radiation with the anterior segment eye diseases using univariate analysis.

3. There is significant association between the socio demographic and occupational data's and the UV radiation with the overall UV-related anterior segment eye diseases using multivariate analysis.

1.8 Definition of Variables

1.8.1 Conceptual definition

1.8.1.1 Anterior segment eye

The eye anterior segment comprises the anterior part of the eye such as cornea, tear film, eye lid, conjunctiva, sclera, pupil, iris, aqueous humour and lens (Fatt and Weissman, 1992).

a) The cornea

The cornea is the clear and transparent part of the eye with a thin, concave tissue layer which is covered by the aqueous humor on the posterior surface and is adjacent to the air on the anterior side across the thin tear film. The cornea has no blood vessels to nourish it or to protect it from infection; the tear and the aqueous humor are those responsible for nourishing it (Fatt and Weissman, 1992).

b) The conjunctiva

The conjunctiva is a transparent tissue covering the white area of the eye (the sclera). It produces the tear film, which is able to lubricate and protect the cornea. It is composed of three layers (Kaufman et al., 2011).

c) The lens

The lens, which consists of a transparent membrane labelled the lens by extracellular matrix known as capsule, is located behind the cornea and pupil (Kaufman et al., 2011).

1.8.1.2 Vision/Visual acuity

The word 'vision' generally refers to the visual acuity of an individual, which is a measurement of focus at a 6 m/20 foot distance. 6/6 or 20/20 vision entails that at 6 m/20 ft, vision in generally unimpaired and is the expected average level of human

visual acuity. However, if a person has 20/100 vision, he / she must be as close as 20 ft to see what a normal person can see with normal vision at 100 ft. This concept was devised by Dr Hermann Snellen, a Dutch ophthalmologist in the 19th century.

1.8.1.3 Prevalence of anterior segment eye diseases

The UV-related eye diseases such as pterygium, pinguecula, cataract, climatic droplet keratopathy (CDK), conjunctivitis, and eye lid lesion have been demonstrated and noticed among the outdoor workers (Taylor et al. 1988).

a) Pterygium

Pterygium is classified as abnormal tissue growth upon the sclera (the white area of the eye). It has been known to extend to the cornea. It has been long established that increased vulnerability to UV radiation can trigger pterygium (Cameron, 1965).

b) Pinguecula

Pinguculae is a fibro-fatty substance develops from conjunctiva on the sclera. According to Norn (1982, 1984), this might be induced by a prolonged outdoor period. There is a huge amount of individuals found to have pinguecula, which resided or worked by the Red Sea.

c) Climatic droplet keratopathy (CDK)

CDK is a degenerative disease where partially opaque matter accrues in the superficial corneal stroma along the interpalpebral strip, which initiates peripherally and emanates to an eventual central spread (Oliva and Taylor, 2005).

d) Cataract

Cataract is lens opacity that is divided into various types of cataract based on the provoked areas. Cataract can be resulted from many reasons and can cause blindness if not treated. Moreover, cataract is also considered to have a relationship with the overexposure to UV radiation, which has been proved by the study carried out by Collman et al. (1988).

e) Photoconjunctivitis

It is an inflammation on the conjunctiva or redness in the sclera, may be triggered by prolonged UV exposure (Bergmanson, 1990).

f) Eye lid lesion

Diseases forming eyelid lesions are inclusive of both benign/malignant diagnoses. Malignancies found within the eyelid were currently found to be correlated with UV-B exposure and it is also evident that there is a strong link between latitude and acquisition of both BCC and SCC (Basal cell carcinoma and squamous cell carcinoma, respectively). Additionally, Newton et al. (1996) have discovered a direct

link between the latitudinal location and the geographical incidence of high UV radiation exposure.

1.8.1.4 UV-Index (UV-I)

UVI as stipulated by the WHO is an index of UV radiation magnitude.The values discussed are ranging from zero to above 11. It was hypothesised that the higher the value, the more likely damage occurs in the eyes or to the skin in a shorter period.UNI is crucial in allowing people to take appropriate action (ICNIRP, 1995).

1.8.2 Operational definition

1.8.2.1 The prevalence of anterior segment eye/diseases

Anterior segment eye diseases were measured using portable slit lamp (ELS-700, Eli-Ezer Company, USA). This lamp is able to investigate and examine the anterior and posterior eye segment parts such as the cornea, lens, conjunctiva, tear film, iris, pupil, retina, and vitreous champer. There are various diseases that were investigated using the same type of portable slit lamp such as eye lid lesion, all types of cataract, corneal disease, and conjunctival diseases including pterygium, pinguecula, photoconjunctivitis, and conjunctival mas. A checklist form has been also used to study the anterior segment eye diseases.

1.8.2.2 Vision/Visual acuity

The vision/visual acuity was measured using screen chart (GLC-1, Gerix Inc, Daejeon, Korea, http://www.gerix.kr/). The test distance can be adjusted from 1.5 to 7 metres. This means that it is useful to be used in the field or even in a small area.

1.8.2.3 Socio demographic

The socio demography was surveyed using questionnaires consisting phone number, age, nationality, educational level, family size, income, smoking, and marital status.

1.8.2.4 Occupational history

The occupational data were also obtained using questionnaires form comprises the number of years working as fishermen, the types of fishing either in the deep sea or short-distant, number of hours working, number of hours spent working in the daylight, and the use of protection equipments.

1.8.2.5 UV-Index (UV-I)

The historical data for a year in specific area of Jazan (the coastal area) were obtained through a meteorology international weather trends in the US (www.weathertrends360.com) from 03/01/2015 to 03/01/2016).

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