CANCER INCIDENCE IN LIBYA RELATIVE TO NEIGHBORING COUNTRIES

A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES

OF

NEAR EAST UNIVERSITY

By

SUMIA HUSSIN MOHAMED ABDUALKARIM

In Partial Fulfillment of the Requirements for the Degree of Master of Science

in

Mathematics

NICOSIA, 2018

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Approval of Director of Graduate School of Applied Sciences

Prof. Dr. Nadire Cavus

We certify that, this thesis is satisfactory for the award of the degree of Master of Sciences in Mathematics

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I have fully cited and referenced all materials that are not original work of this thesis.

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I am internally grateful to Allah for the strength, during the course of this research. I also extend my heartfelt gratitude to my supervisor Prof. Dr. EVREN HINCAL for his immeasurable guidance throughout the course of this study. To my family back home, thanks for the love and support.

To those who believe in me…

ABSTRACT

Nowadays, cancer is a main health problem over the World, with more than 10 million cases a year. If it continues, it is expected to reach 16 million new cases by 2020. According to the World Health Organization, about 65% of these cases will be in developing countries for many reasons, the most important of which are growing pollution, lack of resources, poor exploitation of material and human resources, lack of health awareness, widespread smoking, lack of serious and ongoing programs of prevention and early diagnosis. The study aimed to spotting the light on cancer incidence and mortality in Libya relative to neighboring countries. The Statistical Package for Social Science (SPSS) as well as MS Excel has been utilized in this study. This analysis and evaluation has been done used percentage, Age-Standardized Rate (ASR), one sample T-Test and One Way ANOVA Test to find out the percentages and frequencies of the data descriptive analysis. This study to estimated of the cancer incidence in Libya and comparison with neighboring countries . All kinds of cancer for both gender has been analyzed as percentage and ASR for incidence and mortality.

Keywords: Cancer; Libya; attitude; statistical analysis; ASR

ÖZET

Günümüzde kanser, yılda rastlanılan on milyonu aşkın vaka ile dünya genelinde en önemli sağlık sorunudur. Eğer bu artış devam ederse, 2020 itibarıyla bu rakam 16 milyonu bulacaktır. Dünya Sağlık Örgütü'ne göre bu vakaların %65'i gelişmekte olan ülkelerde görülmektedir. Bunun farklı bir dizi sebebi vardır. En önemlileri, artan kirlilik, kaynaklardan mahrum olma, yeterli maddi kaynaktan ve insan kaynağından istifade edememe, sağlık konusunda bilinçli olmama, yaygın sigara kullanımı, erken teşhis ile sağlık sorunlarının önceden önlenmesine dönük programların yürürlüğe sokulmamasıdır. Bu çalışmanın amacı, Libya ile komşu ülkelerde kanser vakalarına ve ölüm oranlarına ışık tutmaktır. Çalışma dâhilinde Sosyal Bilimler İstatistik Paketi sürüm 24 (SPSS) ile MS Excel'den istifade edilmiştir. İlgili analiz ve değerlendirme, yüzdelik hesapları, Standart Yaş Oranı (ASR), tek grup T-Testi ve Tek Yönlü ANOVA Testi'ne başvurularak gerçekleştirilmiş, böylelikle verilerin açıklanması üzerine kurulu analiz dâhilinde mevcut olan yüzdelikler ve frekanslar (sıklık dereceleri) tespit edilmeye çalışılmıştır. Bu çalışma, 2015'te Libya'da görülen kanser vakalarını komşu ülkelerdeki vakalarla kıyaslamalı olarak ele almaktadır. Her iki cinsiyette görülen her türden kanser türü, vaka ve ölüm oranı temelinde, yüzdelik ve ASR olarak analiz edilmiştir.

Anahtar Kelimeler: Kanser; Libya, tutum; istatiksel analiz; ASR

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CHAPTER 1

INTRODUCTION

1.2 Introduction

Cancer is a major health problem in the World, with more than 10 million cases a year. If it continues, it is expected to reach 16 million new cases by 2020 (Siegel, Miller, & Jemal, 2016). According to the World Health Organization, about 65% of these cases will be in developing countries for many reasons, the most important of which are growing pollution, lack of resources, poor exploitation of material and human resources, lack of health awareness, widespread smoking, lack of serious and ongoing programs of prevention and early diagnosis (Hinçal, Taneri, Taneri, & Djamgoz, 2008).

All of these factors have made the meaning of the word cancer in these societies synonymous with despair and painful death. This is contrary to the scientific concept that cancer is the can be preventable diseases and healing, if discovered in the early stages as well as if follow the lifestyle such as abstain from smoking, avoid drug abuse and follow the nutrition of sound balanced, also not to overuse of meat and fat and exercise regularly. In fact, if cancer is treated under the supervision of a specialist team and a specialized center, half of the injured can be cured.

To achieve this goal and to ensure the success of any national program to combat cancer in a country must be accurately identify the characteristics and rates of cancer that afflicts that community, given the great geographical difference between countries in the world rates of infection, and the link to the disease environmental and behavioral factors. This point given more importance to our research.

This research is statistic and medical geography study, as it is concerned with recording the degree of spread of cancer and its geographical distribution in the state of Libya and neighboring countries and indicating the environmental, geographical, natural and human factors that affect it.

1.2.3 Data collection

The 2015 data on cancer were collected from the official website of the World Health Organization (WHO) for three countries in Libya, Egypt and Tunisia (Organization, 2015). Libya's data were compared with data collected from tumor treatment centers in Libya. These data included cancer incidence and mortality for both men and women, as well as six most common types of cancer, which are breast cancer, Colorectal, Lung, Liver, Prostate and Bladder.

1.2 Research Objectives

The purpose of the study was to use statistical studies to analyze information on cancer incidence in Libya and neighboring countries and make comparison between them ,In addition to achieve the following:

- Study of natural and human geographic factors that may be related to the emergence and development of cancer and its high rates through statistical comparison and geographical conditions.
- Explain the distribution of cancer and its spatial patterns in the study area
- Awareness of the spatial conditions of countries to reduce cancer.
  Also to urge the State on such subjects that were lacking in our country and developing countries in general.

1.3 Research Important

The importance of this research comes from its title. Where this type of studies appears to be a new area that most researchers and statisticians seek to explain the relationship between statistical studies, the geographical environment and human health, as well as the emergence of diseases and their high rates. Determining the positive and negative effects on human life is very important in order to avoid many diseases such as cancer. Given this importance, we will try to draw the best results to be effective in protecting the population and maintaining their health. In addition, sub-importance are listed as follow:

- Spotlight on the cancer as well as the emergence of diseases and high rates.
- This research is statistic and medical geography study.

- This research adding now reference to researchers about cancer.
- Research will contribute as a statistical study to know the increase or decrease incidence of cancer
- The research will contribute to the comparison of countries to find out, which species are more prevalent in the world
- The statistical study will show the rates of inequality and variation in the occurrence from one country to other , which may contribute to know the reasons for the occurrence.

1.5 Research Methodology

The research title is cancer incidence in Libya relative to neighboring countries. The research was divided into five chapters. In the first chapter, presented an introduction to the topics and data collection, highlighting the objectives and importance of research, as well as the limits of the methodology of research. Second chapter is literature review, which including the caner definition and its types, as well as the cancer statistics in the world and Africa with focusing on Libya.

Third chapter is statistic chapter with focus on research sample demography and statistical methods such as percentage, age-standardized rate (ASR), one sample T-test and one-way ANOVA test. Fourth chapter is results and discussions, start with incidence and mortality with comparison in 2012 at Libya, Tunisia and Egypt. As well as hypothesis testing. The final chapter was devoted to analyzing the findings of the study, recommendations and references.

1.6 Research Limitation

The research is limited to the following borders:

- **Topical limitation:** the study is limited to cancer incidence in Libya relative to neighboring countries.
- **The human's limitations:** The study is limited to in population of Libya relative to neighboring countries Tunisia and Egypt.
- **Time limits:** applied study during the academic year 2017/2018.

1.7 The Research Difficulties

The difficulties faced by the researcher during his studies are:

1. The scarcity of data on the disease, and the unwillingness of many officials and staff to cooperate with researcher to obtain medical statistics on cancer.
2. The inaccuracy of the available statistics and in some cases the unreliability of these statistics.
3. Scattering of scientific material related to the subject in many books and references medical and statistical as well as geographical, which force the researcher to go into many of these references in order to formulate the results in a proper statistical framework.

CHAPTER 2

LITERATURE REVIEW

2.1 Cancer

2.1.1 Cancer definition

Cancer is a group of diseases characterized by their cells is hostile, which is growth and division without limits. The ability of these dividing cells to invade and destroy adjacent tissues and to move to distant tissues in a process called transfer. These abilities are the characteristics of malignancy, unlike the benign tumor, which is characterized by specific growth and inability to invade and does not have the ability to move. It can develop the tumor to benign cancer malignant sometimes; cancer can affect all stages of life in humans to the embryos, but increases the risk of infection as the progress of man in age. New cancer cases and cancer deaths have steadily increased (Benyasaad et al., 2017; M El Mistiri et al., 2010).

The transformation of healthy cells into cancerous cells may result in changes in the genetic material. These changes may cause carcinogenic factors such as smoking, radiation, chemicals or infectious diseases such as virus infection. There are also encouraging factors such as a random error or a mutation in the DNA copy at the time of cell division, or because of the inheritance of this mutation or mutation from the mother cell, and genetic changes or mutations occur in the quality of specific genes:

1. **Genetics and tumor:**

They are active genes in the case of a cancer cell to give the cell new properties, such as excessive growth and division, and help the cancer cell to grow in unusual circumstances.

2. **Legitimate tumor genes:**

Genes that are arrested in the case of a cancer cell, because they oppose the formation by correcting any errors in DNA copies, and monitoring the cell division, and works to bind cells and non-transfer, and it helps the immune system to protect the fabric

2.1.2 Cancer types

2.1.2.1 Breast cancer

It is one of the most common types of cancers among women. It occurs most often after the age of 50, but this does not mean that it may not appear at an early age. It is possible to develop the disease in men, but very little by 1% compared to women (Boder et al., 2011; Robertson, Willsher, Cheung, & Blarney, 1997). In last 15 years, thousands of breast cancer patients have been treated (Coleman & Rubens, 1987).

- **Reasons:**

There are factors that help increase the risk of infection, including:

The presence of the disease in a relative, so those whose mothers or sisters were infected with this tumor get used to the self examination.

There is a possibility of increasing the incidence of the disease in women who were first pregnant after the age of thirty, also smoking and excessive alcohol are factors that are believed to be linked to the disease.

- **Symptoms:**

In fact, not every change in the breast is a tumor and not every tumor is malignant, but should not neglect any tumor or change in the shape of the breasts and it is important to see a doctor if observed:

1. The appearance of a lump in the breast
2. Increase in breast or armpit thickness
3. Secretions of the nipple
4. Nipple shrinkage
5. Local pain in the breast
6. Change in breast size or shape

Some of these changes occur naturally in pregnancy, breastfeeding, before and after menstruation in some women. The importance of early detection of breast cancer is that the

cure rate exceeds 95% if the tumor is in its infancy. However, delaying the diagnosis drops to only 25%.

1.2.3.1 Colorectal

As heterogeneous disease the colorectal cancer (CRC) occurs in the colon and the rectum, parts of the gastrointestinal system (Aran, Victorino, Thuler, & Ferreira, 2016; Levine & Ahnen, 2006). All types of colorectal cancer begin with benign mucous polyps. These non-malignant tumors are formed in the large intestinal wall and may eventually grow into cancer. Good results and benign nephrectomy are one of the areas of preventive medicine. In the United States, the colorectal cancer (CRC) is the third most popular diagnosed cancer among both men and women (Siegel et al., 2017).

- **Symptoms:**

1. Bleeding occurs from the rectum.
2. Changes in bowel habits such as constipation or diarrhea. (These symptoms also occur in other diseases, so comprehensive tests should be performed if such symptoms occur).
3. Abdominal pain
4. Weight loss is a symptom that usually appears late and indicates a possible spread of the disease.

- **Reasons:**

1. The presence of colorectal cancer and mucous polyps in family history.
2. Infection of the person with ulcerative colitis, colic or cancer in other organs, especially breast and uterus.
3. There is a belief that hemorrhoids lead to colon cancer which is a false belief.

1.2.3.2 Lung

Is the growth of some of the cells of the layer of the lining of the trachea faster than normal and irregular, which leads to the accumulation and the occurrence of interference in the process of extraction of mucus, and develop some cells multiply quickly and become malignant. These cells contend and destroy normal cells, leading to mucus retention in the lung. Cancer cells form a block or tumor that blocks the trachea, one of the main causes of

death of men and women in most industrialized countries. In the United States, the lung cancer is the leading cause of cancer death among both men and women (Torre, Siegel, & Jemal, 2016).

- **Symptoms:**

1. Shortness of breath.
2. Difficulty in removing sputum from the trachea.
3. Chronic cough.
4. Blood out with phlegm.
5. Pain (rare).
6. Significant weight loss without obvious cause with stress.
7. Voice in the chest during breathing (humming).
8. Difficulty swallowing due to tumor pressure on the esophagus.

- **Reasons:**

1. Smoking, where smokers are more easily exposed than others to lung cancer.
2. High pollution in the air

1.2.3.3 Liver

Liver Cancer is an abnormal and irregular growth of liver cells if the tumor is primary. If secondary, it is spread from one member to another to reach the liver.

- **Symptoms:**

1. Yellowing of the body and eyeball.
2. Pain in the upper abdomen.
3. Loss of appetite and weight
4. Nausea and vomiting.
5. High temperature.
6. Feel tired and idle.

- **Reasons:**

2. Hepatitis B virus infection.
3. Drink heavily.

3.2.3.1 Prostate

Prostate cancer is the most common cancer in men and is the second leading cause of cancer death among men each year in the United States. About one in six men will be diagnosed with prostate cancer during their lifetime, but only one of 35 men will die from the disease. Today, more than 2 million people are alive in the United States who have been diagnosed with prostate cancer at some point in their lives.

Prostate cancer is a malignant tumor that usually begins in the outer part of the prostate. Cancer in most men grows very slowly. In fact, many men with the disease will never know they are suffering from it. Prostate cancer is at an early stage in the prostate gland itself, and the majority of patients with this type of cancer are able to live for years without any problems.

- **Causes**

Prostate cancer is generally considered to be age-related. The older the man, the greater the risk of developing the tumor that some consider him to be one of the diseases of aging. Some of the elderly at the dissection of their bodies has been observed that the cells of the prostate cancer in a very high percentage after death. As a study showed, about 30% of the bodies of the dead at the age of the fourth year was infected with prostate cancer. Therefore, in the case of 30% of those who died at the sixth decade and more than 50% of those who died after the age of eighty-five.

3.2.3.2 Bladder

Bladder cancer occurs when abnormal cells grow in the bladder in a way that is out of control. The bladder is located at the bottom of the abdomen.´Which is a hollow device with a muscle wall that allows it to expand or contract as needed. The bladder stores urine until it is emptied of the body.

Cancer cells are called superficial bladder cancer if they do not spread outside the bladder lining. Cancer cells can sometimes spread to the bladder, lymph nodes, and other organs. It is called invasive bladder cancer.

- **Symptoms**

1. The most common symptoms of bladder cancer are:
2. Blood in the urine
3. Frequent urination in short periods or urgent need to urinate (feeling the need to urinate immediately)
4. Pain during urination or pelvic pain in the lower back.

3.2.4 Causes of cancer

Cancer applies to the principle of plurality of causation, where there are many causes and factors that condense together and lead to disease. These causes and factors correlate with all human activities. The causes of cancer may be found in the food and drink of the human, in the air that he inhales, in the sunlight that illuminates his path, and in the environment in which he works (Mufid El Mistiri et al., 2015).

The individual may also be exposed to these causes and factors due to erroneous habits such as smoking, improper sex or an improper partner, or may be exposed to cancer caused by a doctor's recommended treatment or a diagnostic test. These factors do not affect all types of cancer, but some of them lead to the type or types of this disease are divided into:

3.2.4.1 Genetic factors:

Epidemiological research has shown that genetics and genetic factors are linked to certain cancers. Retinoma tumor appears to be present in more than one child in a family, and breast cancer occurs in some households more than others (Ferlay et al., 2015). The baby is also more likely to develop leukemia. Some types of cancers also show a family distribution such as colon cancer.

3.2.4.2 Environmental factors:

Environmental factors cause about 80-90% of cancers, the most important environmental factors that lead to cancer include:

- **Unhealthy habits and unhealthy lifestyle:**

i. Smoking:

Smoking, whether chewed or smoked, causes several types of cancer. In the United States, smoking in men has led to 90% of lung cancer cases, 75% of cases of oral cancer, pharynx, esophagus and larynx, and about 50% of bladder cancer cases and 40% of pancreatic cancers. In women, smoking causes 75% of lung cancer cases and 40% of cancers of the mouth, pharynx, esophagus and larynx. 30% of bladder cancer and 25% of pancreatic cancer.

ii. Alcoholic beverages:

Too much alcohol is associated with a number of cancers, such as cancer of the pharynx, larynx, esophagus and liver. The relative risk was increased in the tissues that were in contact with undigested alcohol. Therefore, the risk is increased in the cancer of the mouth, pharynx and esophagus. It was also found that people with cirrhosis caused by alcohol influence are more likely to develop liver cancer.

It was found that oral cancer occurs when the concentration of alcohol and increase the effect of smoking habit. The relationship between smoking and cancer of the mouth, esophagus, pharynx and drinking alcohol, where the impact of smoking in the incidence of these species is greater among those who drink alcohol, has shown some epidemiological research, the habit of drinking beer has to do with rectal cancer.

iii. Food:

The epidemiological studies, particularly the studies of the correlation and the relationship of many cancers with the meals received, have been carried out and many epidemiological research studies have been conducted to identify the nutritional risks. Food may be contaminated with carcinogens, such as aflatoxin compounds produced by fungi, or food may contain substances that turn into carcinogens into the body, such as nitrosamine compounds. Studies have shown a link between some types of eating and cancer. There is a link between eating salty Chinese fish and nasal pharynx, as well as eating smoked fish and stomach cancer. There is also a significant relationship between bowel cancer and beef consumption, and eating high-fat diets is associated with colon, breast and prostate cancer.

There is an inverse relationship between eating high-fiber diets and colon cancer. Fibers may increase the volume of bowel contents and thus reduce the concentration of carcinogens

within the bowel cavity. It has been shown that meals rich in fresh vegetables and fruits reduce exposure to cancer of the organs of digestion and breathing, as well as cancer of the uterus and neck, and proved that vitamin A may protect against dorsal cell carcinoma.

iv. Sexual relations:

Multi relationship leads to more cervical cancer. It has also been shown that women who have never married or given birth are more likely to have ovarian cancer, endometrial and breast. The age of having the first child has been linked to breast cancer. Women who have had their first child before the age of 20 are less likely to have breast cancer than women who have given birth after the age of 35 for the first time.

v. Sunbathing:

Sunscreen is a common cause of skin cancer that affects people with light skin.

vi. Infection:

Some viruses and other pathogens may lead to cancer. DNA and RNA have been shown to cause many tumors in animals. The effect of these viruses on humans has also been shown, with epidemiological research showing the association of certain types of DNA viruses with cancer.

vii. Environmental Pollution, Occupational and Industrial Exposure:

Air pollution and exposure to radiation lead to cancer. There are also different occupational factors that lead to cancer and are exposed to the worker while performing his job. For example, many causes of lung cancer such as arsenic, asbestos, nickel, mustard, chromium, and bladder cancer also have chemical causes such as benzene and aromatic amines. Skin and wood workers are also exposed to sinus cancer. Exposure to ionizing radiation leads to many Cancer. This relationship has been studied through a number of research and studies involving individuals exposed to large and medium doses of radiation from atomic bombs, during work or during treatment, as they have been linked to lung, bone, thyroid, skin and leukemia.

3.2.4.3 Medical practices

Several drugs may lead to cancer and leukemia. For example, arsenic compounds, such as Fowler, may lead to skin cancer, and phenastin may lead to bladder cancer. Some studies have shown that estrogen is associated with endometrial cancer, estrogen and progesterone intake are associated with breast cancer risk.

Studies have shown that birth control pills have a positive effect on protection against endometrial and ovarian cancer as well as in the prevention of benign breast tumors, but have been associated with cervical cancer and a low risk of developing liver cancer. It has been shown that taking medications that reduce immunity and may lead to cancer of the retinal ventricle.

3.2.5 Cancer treatment methods

Cancer can be treated by surgery, chemotherapy, radiation therapy, immunotherapy, or treatment using monoclonal antibodies or other means. The treatment test depends on the location and degree of the tumor and stage of the disease, as well as the general condition of the patient. There are also a number of experimental ways to treat cancer under development.

The goal of treatment is the complete elimination of cancer without harm to the rest of the body, sometimes this can be achieved by surgery. However, the tendency of cancer to invade neighboring tissues or spread to distant sites, often limits their effectiveness and chemotherapy is also often limited to effectiveness other tissues in the body. Radiation can also cause damage to normal tissues, because cancer refers to a class of diseases. It is unlikely that there will ever be a single cure for cancer just as there will not be a single cure for all infectious diseases, previously thought that blood vessel inhibitors have the potential to serve for many types of cancer, but this was not the solution in practice the operation.

3.2.5.1 Surgery

In theory, all cancers can be cured but this is not possible. Cancer sometimes spreads to other sites in the body before surgery. In these cases, complete surgical removal is usually impossible to develop. The tumors grow locally, then spread to the lymph nodes. To the rest of the body are examples of surgical operations for cancer, the eradication of breast cancer

for breast cancer cases, and prostatectomy for prostate cancer, and surgery for lung cancer of non-small cells for lung cancer.

The aim of the surgery may be to remove the tumor only or the whole infected organ and the cancer cell is invisible to the eyes, and yet it can grow into a new tumor in a process called relapse. For this reason, the cancer pathologist examines the surgical sample in surgery to determine whether the surrounding tissue is normal, thereby reducing the chance of microscopic cancer cells in the patient's body.

3.2.5.2 Radiotherapy

X-ray therapy or exposure to radiation to kill cancer cells and reduce the size of tumors.

3.2.5.3 Chemotherapy

It is a cancer treatment that using drugs "anti-cancer drugs", which can be destroy cancer cells.

3.3 Cancer statistics

Doctors recommend foods, statistics show that 70% of cancer is due to unhealthy habits such as smoking and lack of interest in fresh and useful foods. The following statistic shows the following distribution among patients with cancer:

- 35% of them are malnourished.
- 30% of them due to smoking.
- 15% due to genetic defect of father or mother.
- 3% because of drinking alcohol.
- 2% due to exposure to ultraviolet radiation and the remaining 15% for various reasons are rare.

It can be seen from this list that a person can reduce the risk of cancer by abstaining from smoking and eating useful foods accompanied by doctors to prevent this disease, and these types of the following:

- Tomatoes
- Green cauliflower

- Soy.
- Radish.
- Watercress.
- Green tea.
- Walnuts.
- Islands.
- Cabbage.
- Red beets.
- Garlic.
- Onions.
- Turmeric.
- Fish.
- Citrus fruit.
- Full flour.
- Apricot.

This does not mean that food is limited to those foods, but the attention to eating them from time to time, and the reduction of red meat has a great impact in the prevention of disease.

3.3.3 Cancer Statistics in the World

According to Health World Organization, the cancer is a leading cause of death group worldwide and accounted for 7.4 million deaths, which is about 13% of all deaths. In addition, the major types of cancer are:

- Breast cancer with 519,000 deaths
- Liver cancer with 610,000 deaths
- Lung cancer with 1.3 million deaths/year
- Stomach cancer with 803,000 deaths
- Colorectal cancer with 639,000 deaths

In fact, about 70% of total cancer deaths occurred in countries that has low- and middle-income. In 2030, deaths from cancer worldwide are projected to continue increasing to

estimate about 11.5 million deaths. In the US 2017, evaluated with about 40,160 deaths occur by breast cancer, which is the second leading cause of cancer death for women (DeSantis, Fedewa, et al., 2016; Siegel et al., 2017; Sighoko et al., 2018). In 2015, the US women about 40,290 breast cancer deaths are expected that from an overview of female breast cancer statistics in the United States according to the American Cancer Society, including data on incidence, mortality, survival, and screening (DeSantis, Fedewa, et al., 2016). Figure 2.1 shows Age Standardized incidence Rates ASR by World maps for all cancers combined in 2012, where Figure 2.1-A for men while Figure 2.1-B for women, according to World Cancer Report 2014 that published by the International Agency for Research on Cancer. As mentioned before the high-income countries with some exceptions recorded the highest incidence rates such as North America and western Europe (together with Japan, the Republic of Korea, Australia, and New Zealand). Like Figure 2.1, Figure 2.2 shows the world maps of age-standardized mortality rates, which is show extensive international variation (Stewart & Wild, 2017).

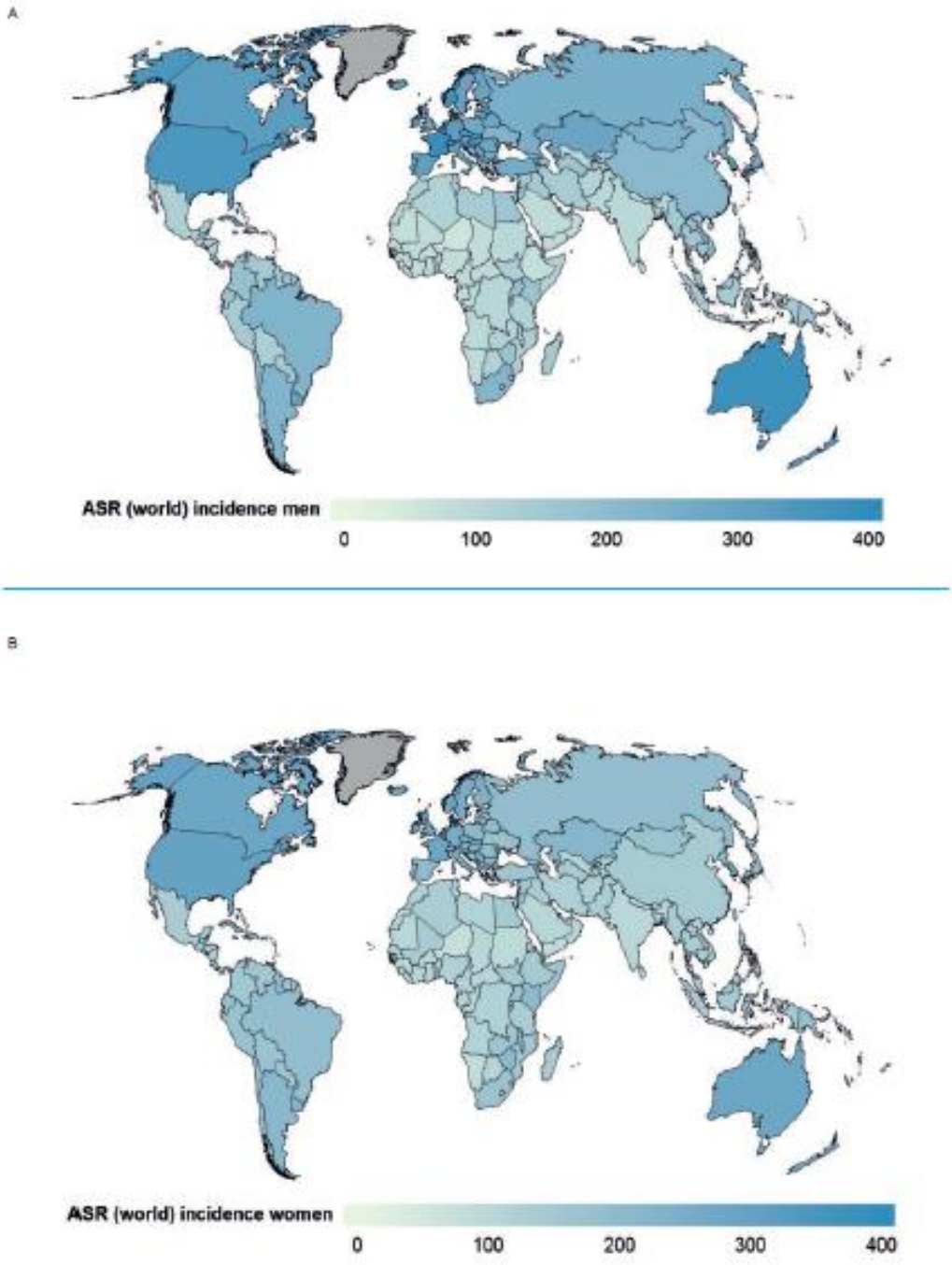

Figure 2.1: Global distribution of (ASR) incidence rates (Stewart & Wild, 2017)

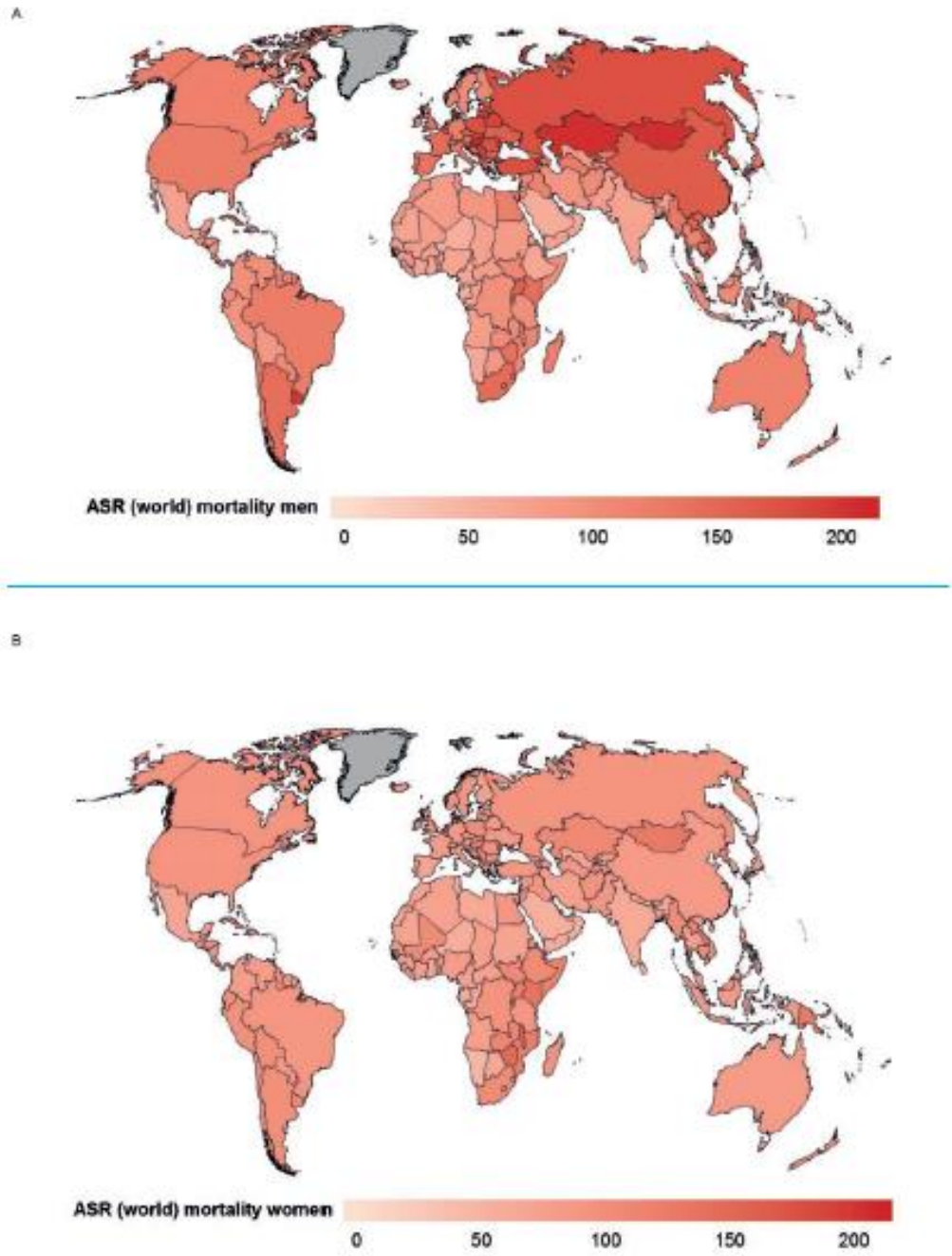

Figure 2.2: Global distribution of e(ASR) mortality rates (Stewart & Wild, 2017)

3.3.4 Cancer Statistics in Africa

The African Americans in the United States, bear a disproportionate share of the cancer burden, having the highest death rate and shortest survival if compared with any racial or

ethnic group for most cancers (DeSantis, Siegel, et al., 2016). In fact, about two thirds of worldwide deaths occurred in low- and middle- income countries such as African countries. The cervix cancer, breast, liver and prostate in addition the Kaposi's sarcoma and non-Hodgkin's lymphoma are the most popular cancers in the African Region. Some researchers rise in the number of cases of cancer is due to ageing populations. Moreover, risk behavior like consumption of unhealthy diets, lack of physical exercise, harmful use of alcohol and tobacco use that populations follow contribute to cancer.

Never forget the infections due to human papillomavirus and hepatitis B and C viruses in the African Region significantly contribute to the burden of the top two cancers, namely cervical and liver cancer respectively.

Table 2.1: ASR for incidence and mortality in Africa (Morhason-Bello et al., 2013)

	Incidence in Africa, ASR			**Mortality in Africa, ASR**		
	Men	Women	Both sexes	Men	Women	Both sexes
Bladder	6.7 (3.7)	1.7(1.5)	4.0(2.5)	4.8(2.8)	1.2(1.1)	2.9(1.8)
Breast	---	28.9(26.3)	--	--	16.0(15.3)	--
Cervix uteri	--	25.2(31.7)	--	--	17.6(22.5)	--
Colorectum	6.9(6.8)	5.0(4.7)	5.9(5.7)	5.5(5.5)	4.0(3.8)	4.7(4.6)
Kaposi's sarcoma	6.0(8.1)	2.8(3.6)	4.3(5.7)	5.1(6.9)	2.3(3.1)	3.6(4.8)
Liver	11.7(13.1)	5.3(6.3)	5.0(9.5)	11.7(13.2)	5.5(6.6)	8.4(9.7)
Lung	8.4(5.9)	1.4(2.0)	5.0(3.7)	7.9(5.6)	1.9(1.9)	4.7(3.6)
Non Hodgkin lymphoma	6.3(8.5)	4.1(3.8)	5.2(4.6)	5.3(4.6)	3.5(3.2)	4.3(3.8)
Esophagus	6.7(8.5)	3.5(4.2)	5.0(6.2)	6.5(8.2)	3.4(4.0)	4.8(6.0)
Ovary	--	4.2(1.5)	--	--	3.4(3.2)	--
Prostate	17.5(21.2)	--	--	12.5(15.0)	--	--

3.3.5 Cancer statistics in 20ibya

In the absence of information in Libya, the situation remains complex on the number of people with cancer, while some statistics say that 6077 people join the cancer patients in Libya annually. The largest proportion of people infected with colorectal cancer by 12% each of the total cancer patients in the country. Followed by breast cancer (11%), bladder cancer (6.4%), and cancer (59%). Nevertheless, the incidence of breast cancer remains the highest among all cancers in females.

The purposes of research, planning and evaluation of programs for cancer control are essential depend on statistics on cancer occurrence and outcome (Ferlay et al., 2010; Organization, 2002; Parkin, 2006). However, the World Health Organization WHO has been published a report in 2014, that static report shows some figures that explains the cancer patients in Libya in details. Figure 2.3 shows the Libyan cancer incidence for female 2014, where breast cancer came as the highest number of cases, which the highest number of cases for men became as lung cancer according to World Health Organization, as shown in Figure 2.4. Figure 2.5 shows Age-Standardized Rate cancer mortality of Libyan male, lung came as highest ASR death per 100,000. The highest Age-Standardized Rate cancer mortality of Libyan female came as breast and colorectal as shown in Figure 2.6. In addition, Cancer mortality profile for Libyan male shown in Figure 2.7 and female in Figure 2.8.

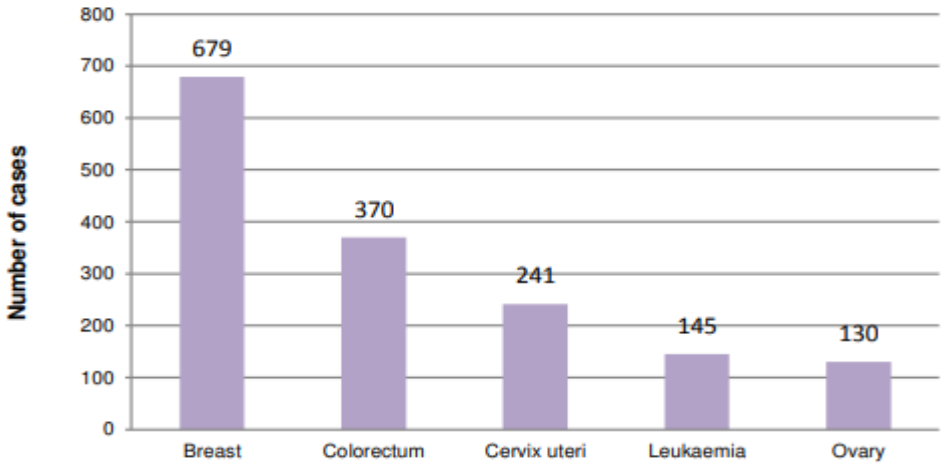

Figure 2.3: The Libyan cancer incidence for female 2014

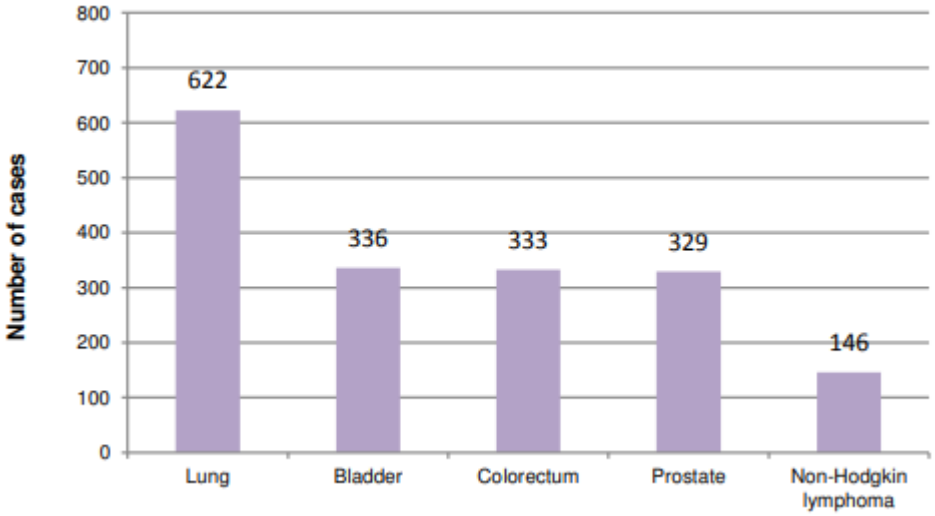

Figure 2.4: The Libyan cancer incidence for male 2014.

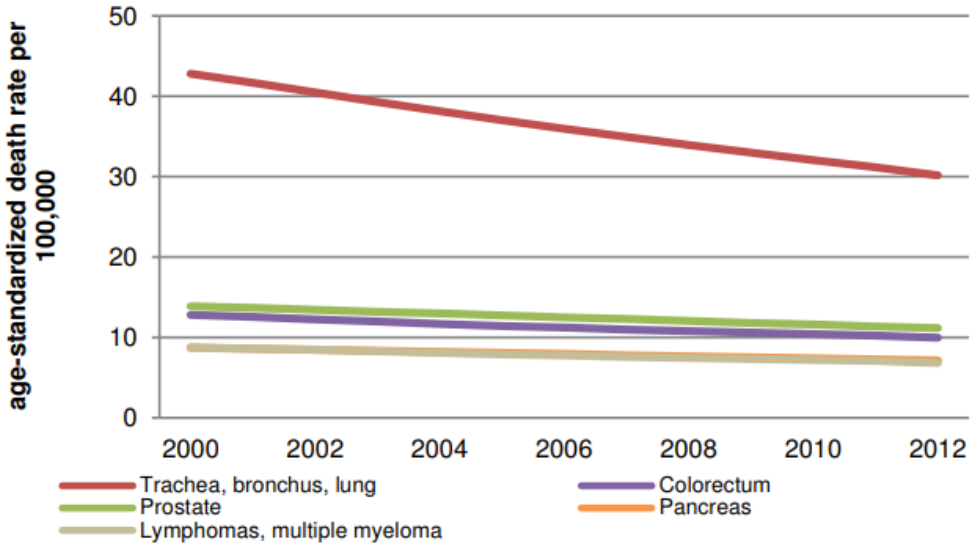

Figure 2.5: Age-Standardized Rate cancer mortality of Libyan male

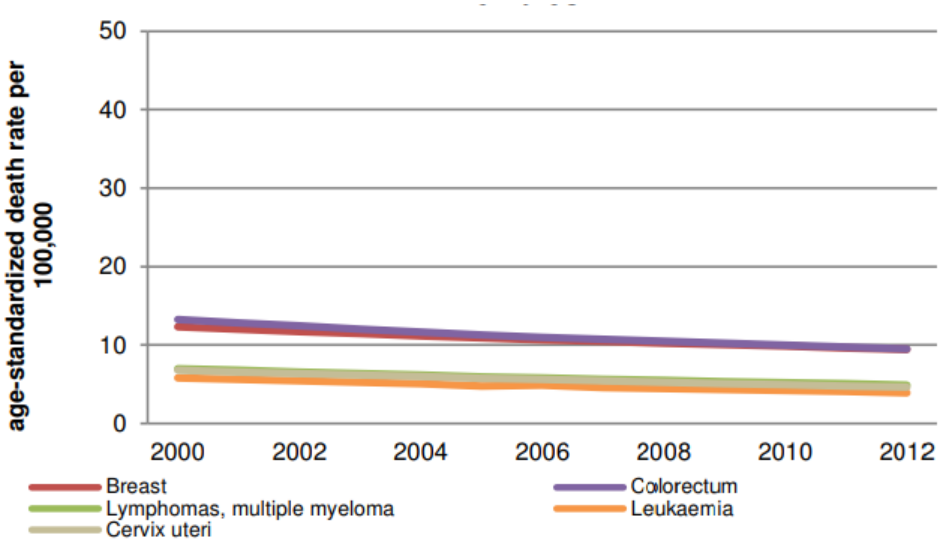

Figure 2.6: Age-Standardized Rate cancer mortality of Libyan female

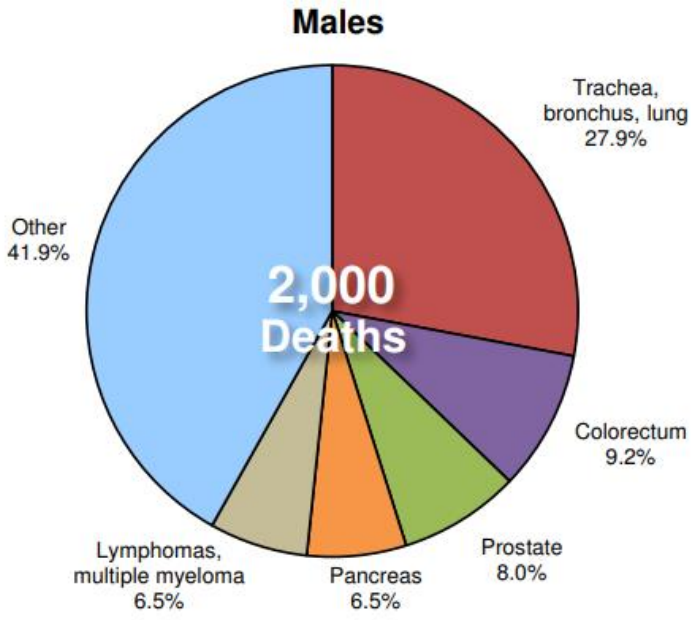

Figure 2.7: Cancer mortality profile for Libyan

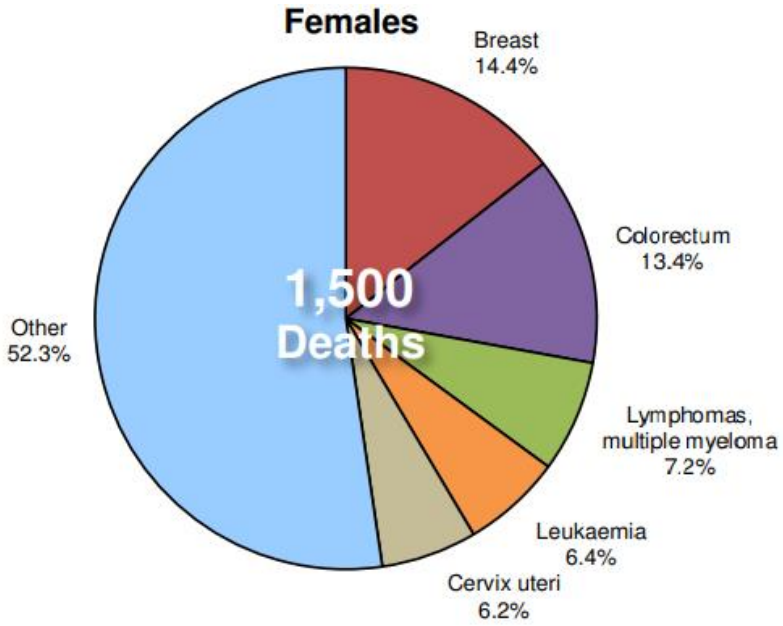

Figure 2.8: Cancer mortality profile for Libyan

CHAPTER 3

RESEARCH METHODOLOGY

In this chapter research methods are explained and discussed for Libya , Egypt and Tunisia.

3.1 Research Sample

3.1.1 Libya

Libya is an Arab country located in the northern part of the African continent as shown in Figure 3.1. It is the fourth largest country in Africa in terms of area. It has a total area of about 1.8 million square kilometers. It occupies the 16th largest country in the world and is surrounded by the Mediterranean Sea, on the eastern side are the states of Egypt and Sudan, and on the south-east is Chad, while the Niger and Morocco are surrounded by the south.

Tripoli is the capital of Libya and the largest city, and the origin of the name of the state to the tribe of Libyou. Who lived in the region between Egypt and Tunisia in northern Africa, and the State of Libya is one of the richest countries with oil reserves; it ranks ninth among the largest countries in the world with the largest oil reserves.

Figure 3.1: The Libyan borders in map

The climate of the Libyan state is moderate in autumn and spring, while it is characterized by hot summers and relatively cold in the winter, with varied climate dominated by the Mediterranean climate, semi-desert climate prevails in the northern and central parts of it, while the desert climate prevails in the southern parts of the country.

It is characterized by the coldness of winter, the heat in summer, and the low amounts of rainfall falling. In fact, Libya does not have permanent water resources of surface runoff because of the low amounts of rainfall falling, fluctuation and geological formation, so the state relies on groundwater ground water by 95.6% Depending on the waters of the valleys by 27%.

3.1.1.1 Demography

The population density of Libya is about 50 inhabitants per square kilometer (130 / sq. Mi) in the northern regions of Tripoli, but is located on less than one person per square kilometer (2.6 / sq. Mi).) in another place. Ninety percent of the population lives in less than 10% of the area, primarily along the coast.

About 88% of the population is urban, mostly concentrated in the three largest cities, Tripoli, Zawiya and Benghazi. Thirty percent of the population is estimated to be under the age of 15, but this percentage has declined significantly over the past decades. These are some information according to World Health Organization:

- Total population (2015) 6,278,000
- Gross national income per capita (PPP international $, 2009) 28,110
- Life expectancy at birth m/f (years, 2015) 70/76
- Probability of dying under five (per 1 000 live births, 0) not available
- Probability of dying between 15 and 60 years m/f (per 1 000 population, 2015) 176/99
- Total expenditure on health per capita (Intl $, 2014) 806
- Total expenditure on health as % of GDP (2014) 5.0

3.2 Statistical methods

The Statistical Package for Social Science (SPSS) as well as MS Excel has been utilized in this study. This analysis and evaluation has been done used percentage, Age-Standardized Rate (ASR), one sample T-Test and One Way ANOVA Test to find out the percentages and frequencies of the data descriptive analysis.

3.2.1 Percentage

The percentage of Libya for each cancer type for both male and female patients was compared with neighboring countries by graphical forms using SPSS.

3.2.2 Age-standardized rate (ASR)

All basic value of Tunisia, Egypt and Libya for each type of cancer were compared in graphic formats for each type. the main objective is find out the ASR of mortality by compare the mortality rates of countries with respect of the difference in age distributions from country to country. In fact, without utilizing ASR, it would be unclear if differing mortality rates were due to age or as a result of other factors.

Age standardized rate means . the incidence rate of a particular disease in a population if that population had a standard age structure. Age standardized rate synonyms .ASR

Comparing rates between two time periods two different geographical areas is usually more representative when taking into account differences in the age structure of the two populations. Age- standardized rates are often used to make such comparisons , as they account for the differences in the age structure of the populations being compared the age standardized rate is a summary of the individual age – specific rates using an external population is called a standard population

Age-standardized rate $\sum_{k=1}^{n} \left(\frac{m_k}{p_k}\right) * s.p$ (3.1)

S.P= standard population in age group k

m_k=Observed cases (mortality or incidence rate per 100,000 persons) in age group

K=age group 0,1-4,5-9 ,…80-84,85 years and over

$\frac{m_k}{p_k}$= Age-specific in age group

3.2.3 One sample T-Test

To know whether a sample comes from a population with a specific mean, one-sample t-test is utilizing. In general, to find out the population mean is not always known, while in this research was used hypothesis tests.

3.2.4 One way anova test

ANOVA test is analysis of Variances technique utilizing to hypothesis testing. In addition, ANOVA test is using as well to test the equality of two or more population means by examining the variances of samples that are taken. ANOVA test alloy researcher to know that the differences between the samples are simply due to random error or whether there are systematic treatment effects that causes the mean in one group to differ from the mean in another.

CHAPTER 4

RESULTS AND DISCUSSIONS

In this chapter research at the cancer incidence and mortality rales are their Libya, Egypt and Tunisia.

4.1 Incidence and mortality in 2015

4.1.1 Percentage

1. **Libya**

Percentage of incidence and mortality in Libya 2015

Table 4.1 shows the estimated incidence and mortality for Libyan men, the occurrence of lung cancer in the male Libyan population is highest with nearly 28% compared with other cancers. Another noticeable observation is that liver cancer was the smallest age standardized ratio about (5.4%).

Table 4.1: Estimated incidence and mortality for Libyan men

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	333	19.2	14.6	184	16.2	8.2
Liver	123	7.1	5.4	114	10.1	5.2
Lung	612	35.3	28.0	554	48.9	25.2
Prostate	329	19	15.5	157	13.8	7.4
Bladder	336	19.4	15.3	125	11	5.8
All cancers	1733	100.0	78.8	1134	100.0	51.8

Estimated incidence and mortality for Libyan women has been shown in Table 4.2. It is significant that breast cancer in the Libyan female population nearly doubled about (24%) compared with other cancers. On the other hand there are some similarities ASR between liver and bladder cancers. The highest incidence percentage was breast cancer with 53% and 24.1 for ASR. While highest mortality percentage was 36.4% and 27.5 ASR for breast cancer as well.

Table 4.2: Estimated incidence and mortality for Libyan women

Cancer	**Incidence**			**Mortality**		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	370	29	14.3	207	33.8	8.1
Liver	94	7.3	5.1	87	14.2	3.6
Lung	87	6.8	9.7	78	12.7	4.0
Bladder	50	3.9	5.0	18	2.9	3.4
Breast	679	53	24.1	223	36.4	8.4
All cancers	1280	100.0	58.2	613	100.0	27.5

Table 4.3 shows the estimated incidence and mortality for Libyan both sexes, where one of first things to note is that lung cancer the highest incidence percentages in both Libyan sexes with 23.5% and 36.2 % mortality. Slight decrease in Colorectum cancer whereas liver cancer is the lowest incidence percentage in 2015 with 7.2% and 4.8 ASR, while the lowest mortality percentages was Bladder cancer with 8.2% and 3.2 ASR.

Table 4.3: Estimated incidence and mortality for Libyan both sexes

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	698	23.1	14.5	391	22.4	8.2
Lung	709	23.5	15.7	632	36.2	14.1
Liver	217	7.2	4.8	201	11.5	4.5
Prostate	329	10.9	15.5	157	8.9	7.4
Bladder	386	12.8	8.6	143	8.2	3.2
Breast	679	22.5	24.1	223	12.8	8.4
All cancers	3018	100.0	83.2	1747	100.0	45.8

2. Tunisia

Percentage of incidence in Tunisia 2015

The most striking feature is that the numbers of lung cancer in the Tunisian male, which recorded 43.3% and 31.1 ASR as incidence while 55.8% and 27.8 ASR mortality. Another noticeable observation is that liver cancer was the lowest percentages and age standardized ratio with 1.9% and 1.4 as incidence as well as 2.6% and 1.3 as mortality, as shown in Table 4.4.

Table 4.4: Estimated incidence and mortality of Tunisian men

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	631	16.8	11.9	379	14.5	7.1
Liver	70	1.9	1.4	67	2.6	1.3
Lung	1631	43.3	31.1	1461	55.8	27.8
Prostate	618	16.4	11.3	353	13.5	5.8
Bladder	814	21.6	15.3	356	13.6	6.5
All cancers	3764	100.0	71.0	2616	100.0	48.5

Table 4.5 shows the estimated incidence and mortality for Tunisian women, where the breast cancer in the female Tunisia population nearly 69.1% and 31.8 ASR compared with other cancers. On the other hand, liver cancer was the lowest percentage of ASR with 1.7% and 0.8 as incidence while the mortality recorded 3.5% and 0.7.

Table 4.5: Estimated incidence and mortality for Tunisia: women

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	572	21.6	10.0	342	29.9	5.9
Liver	44	1.7	0.8	40	3.5	0.7
Lung	98	3.7	1.7	91	8	1.6
Bladder	104	3.9	1.8	46	4	0.7
Breast	1826	69.1	31.8	624	54.6	10.9
All cancers	2644	100.0	46.1	1143	100.0	19.8

Table 4.6 shows the estimated incidence and mortality for Tunisian both sexes, the feature that stands out is that breast cancer in both Tunisian sexes recorded the highest incidence percentages and ASR with 28.3% and 31.8. While as mortality percentage and ASR lung cancer with 41.3% and 14.

Table 4.6: Estimated incidence and mortality for Tunisia: both sexes

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	1203	18.7	10.9	721	19.2	6.4
Liver	144	2.2	1.1	107	2.8	1
Lung	1729	26.9	16.0	1552	41.3	14.3
Prostate	618	9.6	11.3	353	9.4	5.8
Bladder	918	14.3	8.3	402	10.7	3.5
Breast	1826	28.3	31.8	624	16.6	10.9
All cancers	6438	100.0	79.4	3759	100.0	41.9

3. Egypt

Percentage of incidence in Egypt 2015

Table 4.7 shows the estimated incidence and mortality for Egyptian men. The most striking feature is that the numbers are steadily higher in liver cancer in the Egyptian men incidence and mortality, which recorded 45.1% and 38.1 ASR incidence while mortality 55.6% and 37.0 ASR. Another noticeable observation is that Colorectum cancer was the smallest age standardized ratio about 7.7% and 6.1 ASR incidence also 6.4% and 4.4 as mortality.

Table 4.7: Estimated incidence and mortality for Egyptian men

Cancer	**Incidence**			**Mortality**		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	2115	7.7	6.1	1367	6.4	4.1
Liver	12493	45.4	38.1	11910	55.6	37.0
Lung	3634	13.2	11.2	3245	15.1	10.1
Prostate	2358	8.6	7.8	1513	7.1	5.1
Bladder	6902	25.1	21.8	3388	15.8	11.1
All cancers	27502	100.0	85.0	21423	100.0	67.4

The estimated incidence and mortality for Egyptian women has been shown in Table 4.8. It is significant that breast cancer in the incidence and mortality Egyptian women almost the highest compared with other cancers, which recorded 54.1%, 49.5 and 46.1%, 19.3 respectively. Then liver cancer came as a second of incidence and mortality Egyptian women with 17.6% and 14.1 as incidence, and 31.4% and 13.3 as mortality. On the other hand, lung cancer was the lowest percentage of ASR.

Table 4.8: Estimated incidence and mortality for Egyptian women

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	1945	6.7	5.2	1265	8.1	3.4
Liver	5128	17.6	14.1	4860	31.4	13.3
Lung	1383	4.7	3.8	1243	8	3.4
Bladder	2021	6.9	5.6	993	6.4	2.7
Breast	18660	64.1	49.5	7161	46.1	19.3
All cancers	29137	100.0	78.2	15522	100.0	42.1

The feature that stands out is that breast cancer in Egyptian both sexes is steady increase in the type of cancer, which recorded 32.9% and 49.5 ASR incidence while as mortality liver cancer recorded the highest values with 44.9% and 24.5 ASR. Whereas Colorectum cancer is the lowest percentage in 2015, as shown in Table 4.9.

Table 4.9: Estimated incidence and mortality for Egyptian both sexes

Cancer	Incidence			Mortality		
	Number	(%)	ASR (W)	Number	(%)	ASR (W)
Colorectum	4060	7.2	5.6	2632	7.0	3.7
Liver	17621	31.1	25.6	16770	44.9	24.5
Lung	5017	8.9	7.2	4932	13.2	6.5
Prostate	2358	4.2	7.8	1513	4.0	5.1
Bladder	8923	15.7	13.1	4381	11.7	6.5
Breast	18660	32.9	49.5	7161	19.2	19.3
All cancers	56639	100.0	108.8	37389	100.0	65.6

4.1.2 Percentage comparison In 2015

4.1.2.1 Incidence percentage comparison

1. Percentage Estimated of incidence in Libya, Tunisia and Egypt 2015 (male).

Percentage Estimated of incidence in Libya, Tunisia and Egypt 2015 (male), has been shown in Figure 4.1. It can be seen that the highest proportion of male in Libya and Tunisia was for lung cancer, while Egypt had the highest rate of liver cancer in male.

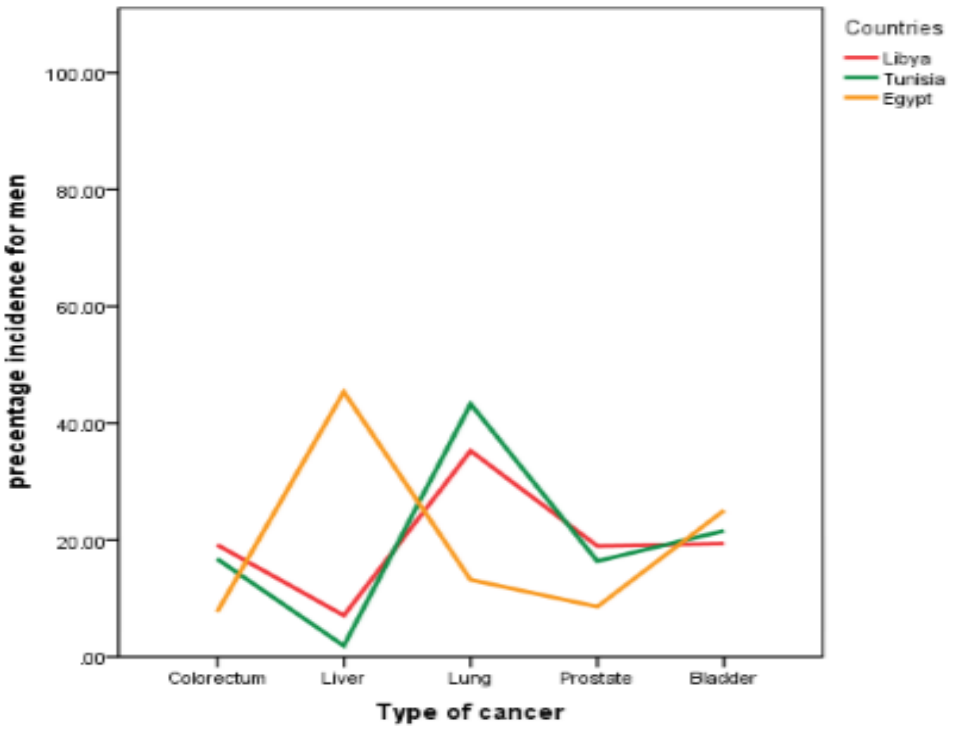

Figure 4.1: Percentage Estimated of incidence male of all countries 2015

2. Percentage Estimated of incidence in Libya, Tunisia and Egypt 2015 (female)

Percentage Estimated of incidence female in Libya, Tunisia and Egypt 2015 has been shown in Figure 4.2. Analysis shown that the highest percentage in Libya was for breast cancer as well as Tunisia and Egypt, and as we note Tunisia has a higher percentage of Libya and Egypt

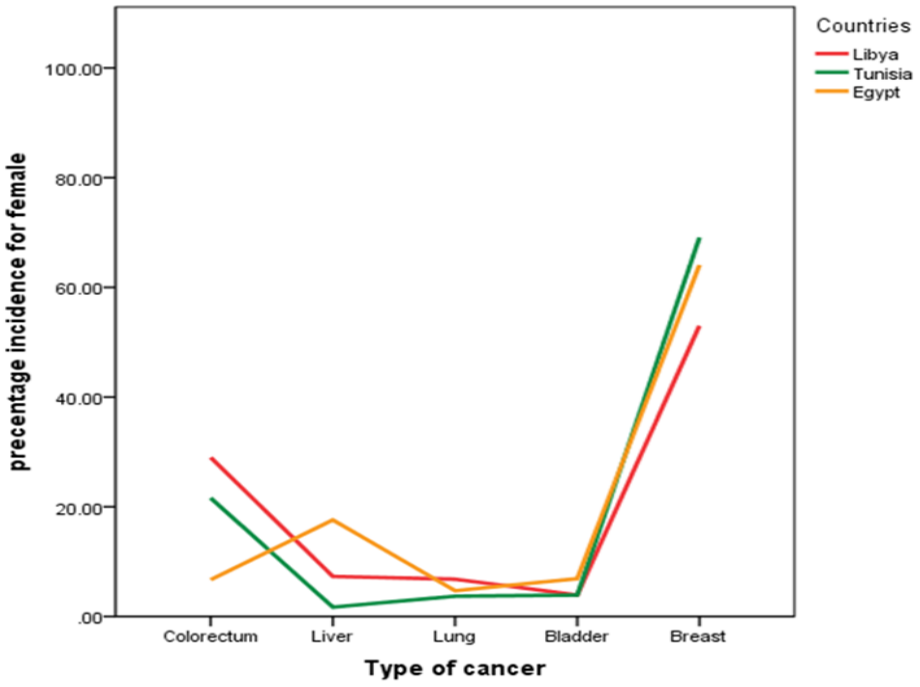

Figure 4.2: Percentage Estimated of incidence female of all countries 2015

3. Percentage Estimated of incidence in Libya, Tunisia and Egypt 2015 foe both sexes.

Figure 4.3 shows the percentage estimated of both sexes incidence in Libya, Tunisia and Egypt 2015. The results indicated very high values in liver cancer in Egypt followed by lung cancer in Tunisia then Libya. While the lowest percentages was liver cancer in Tunisia.

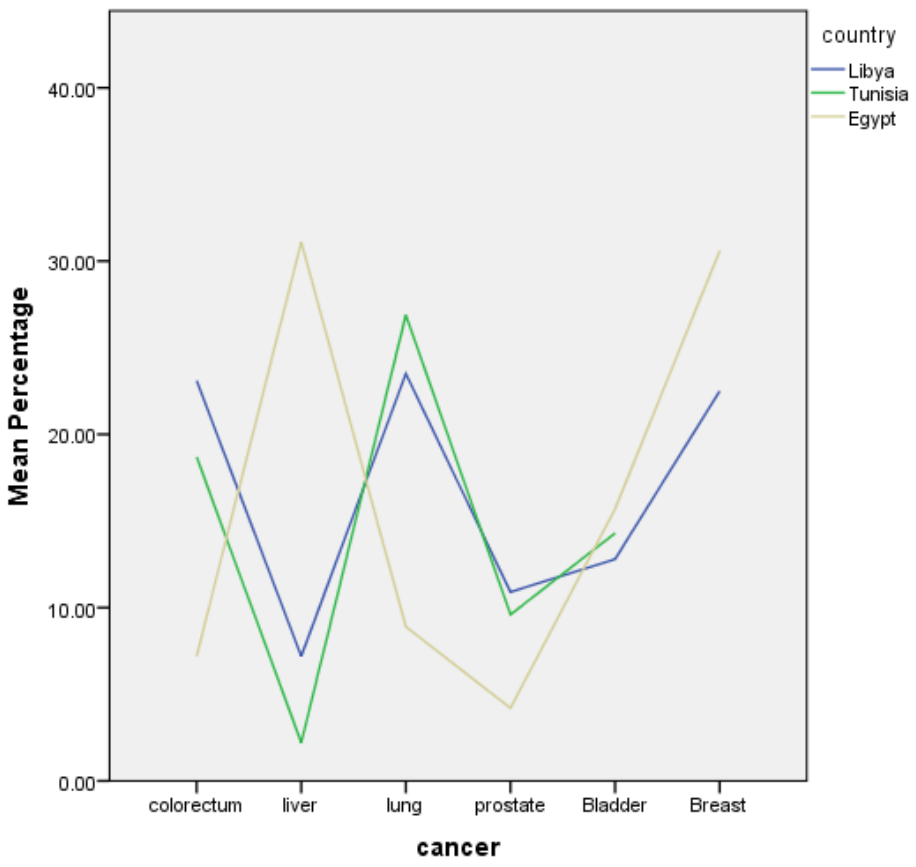

Figure 4.3: Percentage Estimated of both sexes incidence of all countries 2015

4.1.2.2 Mortality percentage comparison

1. Percentage estimated of male mortality in Libya, Tunisia and Egypt 2015.

In fact, liver cancer still the highest percentages values in both sexes in Egypt, while in Tunisia lung cancer recorded the highest percentage value as well as in Libya. On other hand, the lowest percentage values was liver cancer in Tunisia, as shown in Figure 4.4.

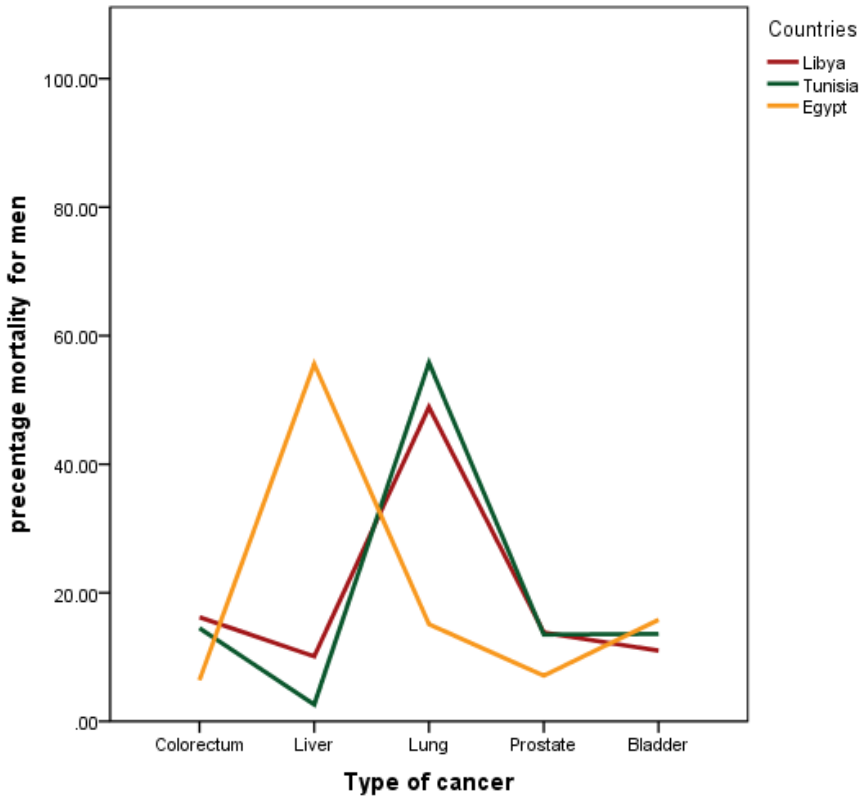

Figure 4.4: Percentage estimated of male mortality of all countries 2015

2. Percentage estimated of female mortality in Libya, Tunisia and Egypt 2015.

Figure 4.5 shows that the highest percentages values recorded by Tunisian female with breast cancer followed by Egyptian female, while the lowest percentage value of all cancer types was with Libyan female.

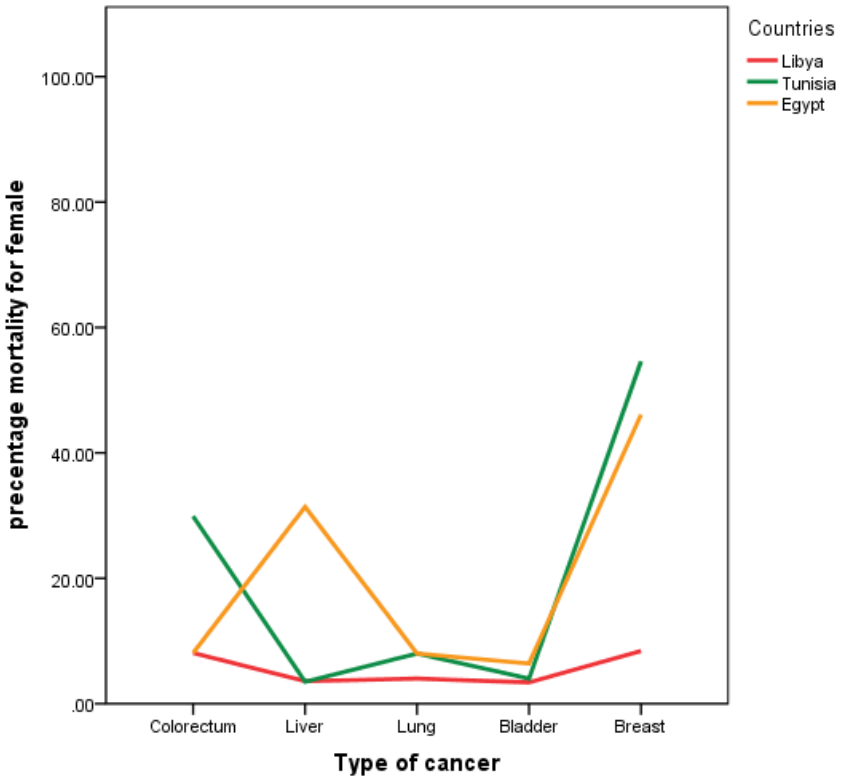

Figure 4.5: Percentage estimated of female mortality of all countries 2015

3. Percentage estimated of both sexes mortality in Libya, Tunisia and Egypt 2015.

The percentage estimated of both sexes mortality in Libya, Tunisia and Egypt 2015 shown in Figure 4.6. As same as the incidence percentages, the highest mortality percentages recorded by Egyptian as liver cancer followed by Tunisian and Libyan with lung cancer. The lowest mortality percentage recorded by Tunisia with liver cancer.

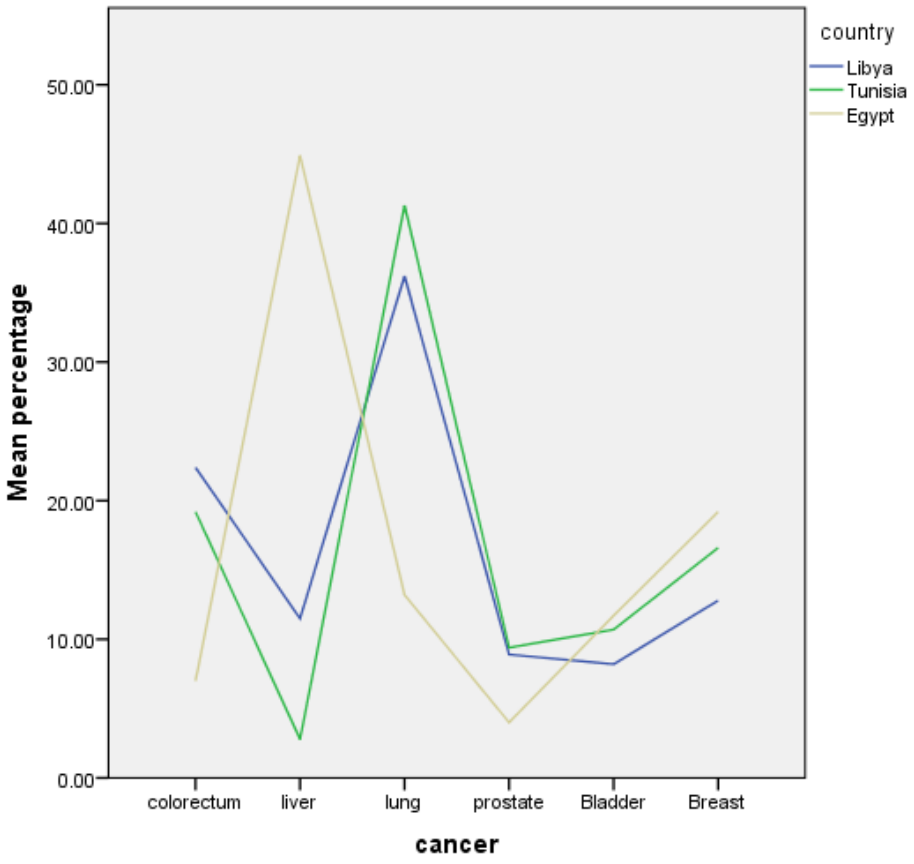

Figure 4.6: Percentage estimated of both sexes mortality of all countries 2015

4.1.3 Age-Standardized rate per 100,000 (ASR)

- ASR of incidence and mortality 2015

All basic value of Libya, Tunisia and Egypt and for each type of cancer incidence and mortality were calculated and compared in graphic formats for each type of cancer as well as for male and female.

4.1.3.1 For male

ASR Estimated of incidence and mortality in Libya, Tunisia and Egypt 2015 (Male)

- **Colorectum**

Figure 4.7 shows the ASR estimated of male incidence and mortality by Colorectum in Libya, Tunisia and Egypt 2015. The figure shows a gradient in the results in both incidence and mortality, where the highest value was Libya while the lowest was Egypt.

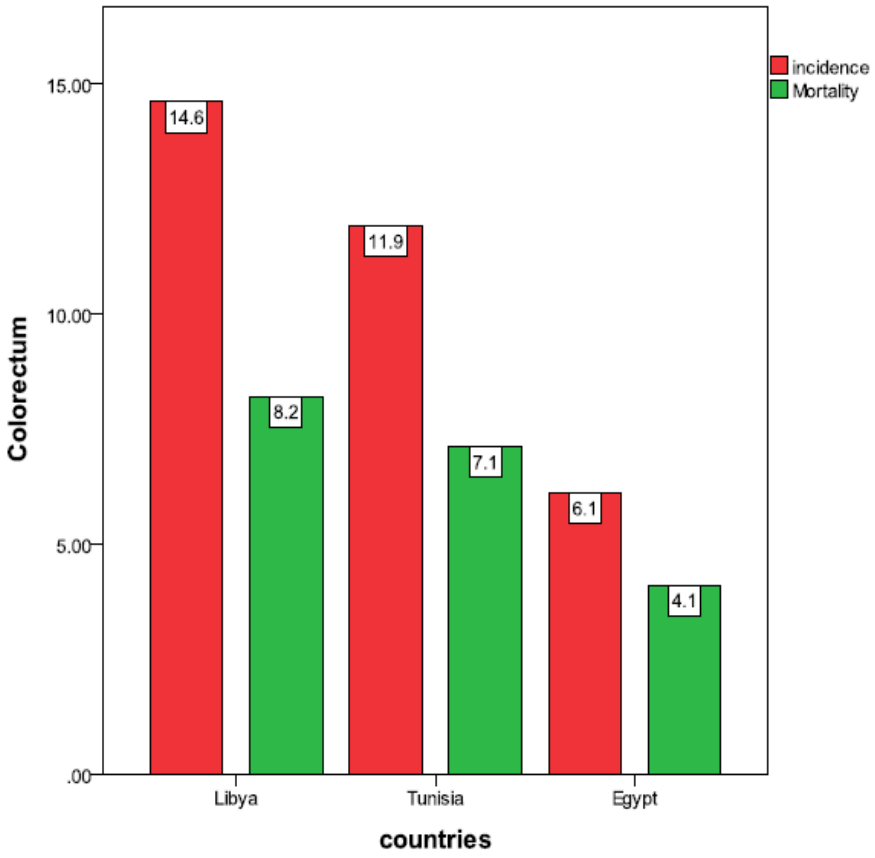

Figure 4.7: Colorectum ASR of male incidence and mortality of all countries

- **Liver**

The ASR estimated of male incidence and mortality by liver cancer in Libya, Tunisia and Egypt 2015 shown in Figure 4.8. The highest value in liver cancer was Egypt with high difference with second, which is Libya and the lowest value was Tunisia.

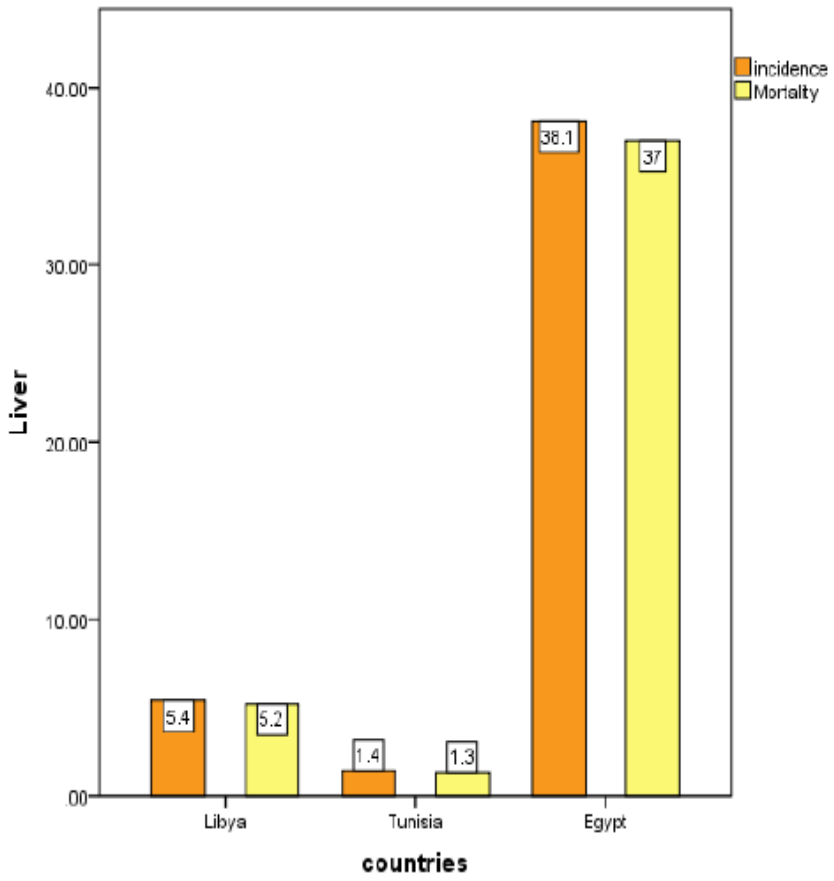

Figure 4.8: The liver ASR of male incidence and mortality all countries

- **Lung**

Figure 4.9 shows the results of ASR estimated of male incidence and mortality by lung cancer in Libya, Tunisia and Egypt 2015. The figure shows convergence in the results in between Tunisia and Libya, where Tunisia came as the highest value then Libya and in lowest value Egypt.

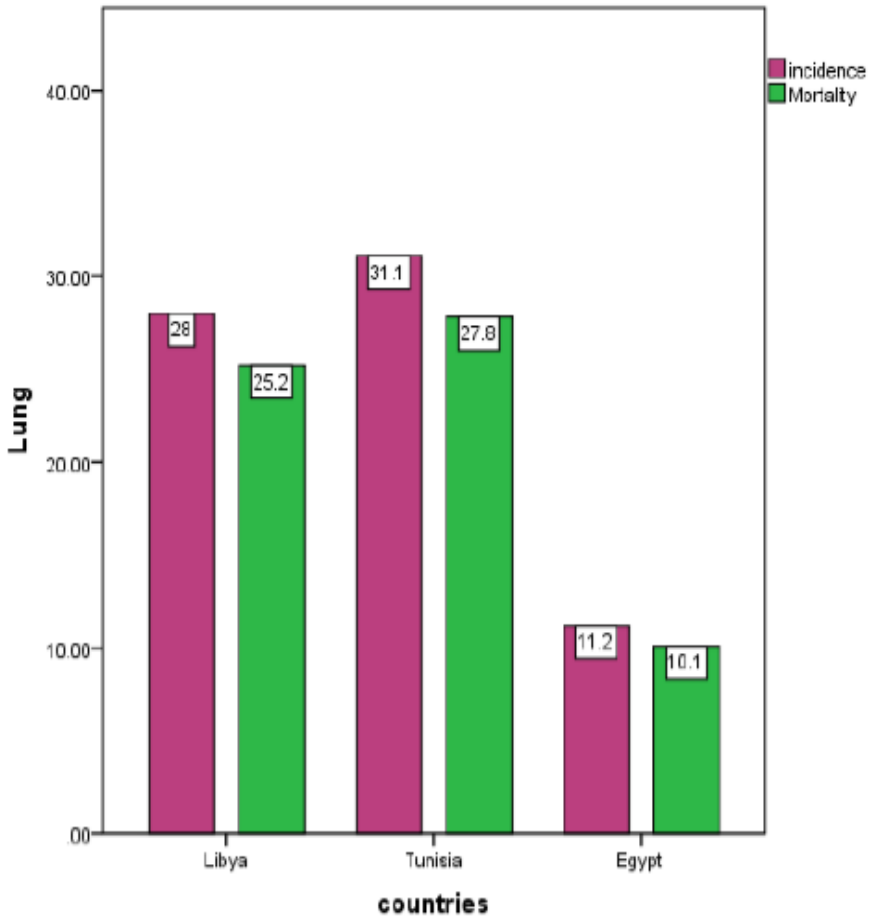

Figure 4.9: Lung ASR of male incidence and mortality of all countries

- **Prostate**

Figure 4.10 shows the results of ASR estimated of male incidence and mortality by prostate cancer in Libya, Tunisia and Egypt 2015. The figure shows a gradient in the results in both incidence and mortality, where the highest value was Libya incidence and mortality female then Tunisia came as second while the lowest ASR values were Egypt.

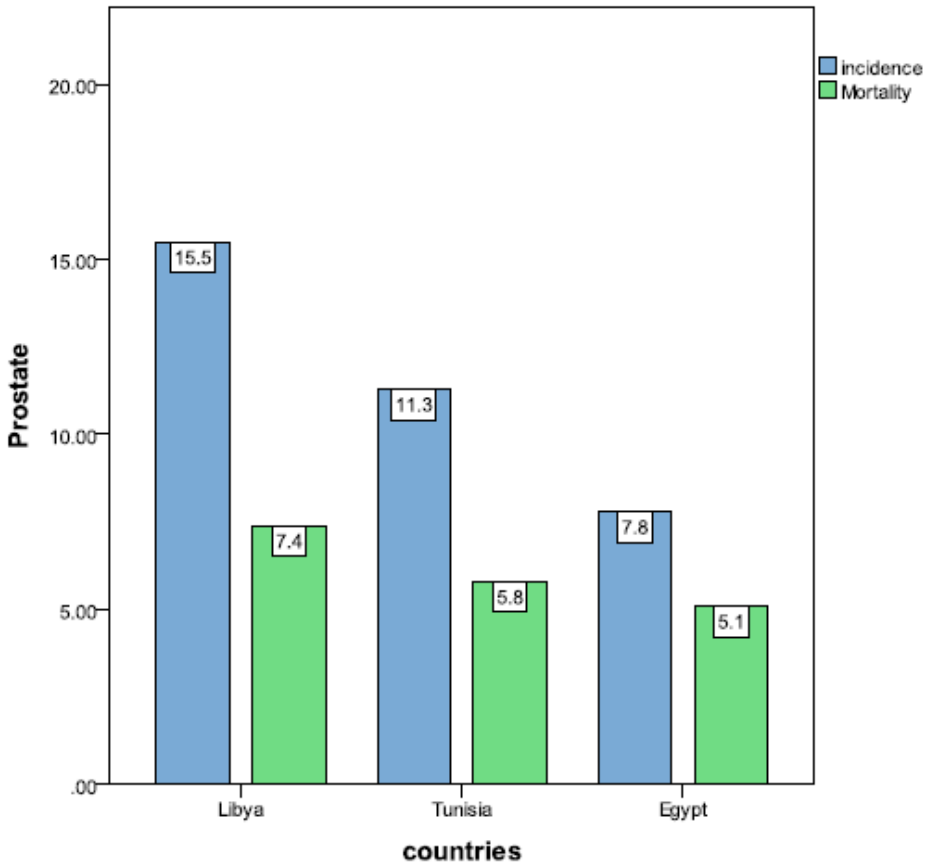

Figure 4.10: Prostate ASR of male incidence and mortality of all countries

- **Bladder**

Figure 4.11 shows the results of ASR estimated of male incidence and mortality by bladder cancer in Libya, Tunisia and Egypt 2015. In bladder cancer, the results similarity, in incidence values between Libya and Tunisia. On other hand, Egypt recorded the highest values in male incidence and mortality by bladder cancer.

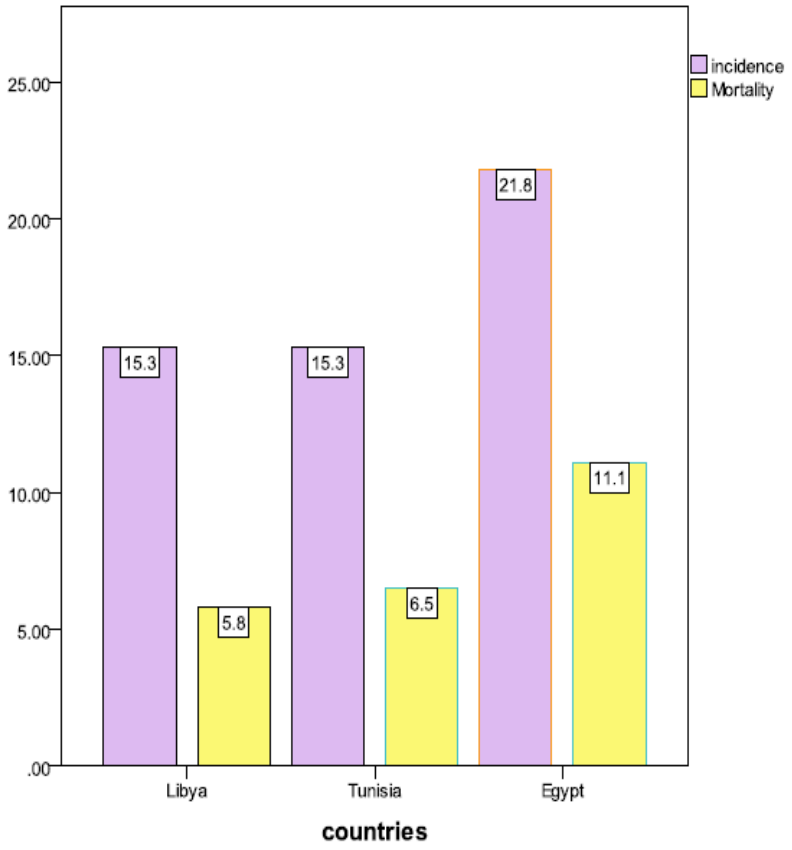

Figure 4.11: Bladder ASR of male incidence and mortality of all countries

4.1.3.2 For female

- **Breast cancer**

Mortality from one side and the countries from other side. Where, Egypt recorded the highest value in both incidence and mortality followed by Tunisia and the lowest was The results of ASR estimated of female incidence and mortality by Breast cancer in Libya, Tunisia and Egypt 2015 shown in Figure 4.12. Gradient relationship has been indicated in the results, where big difference has been found between incidence and Libya.

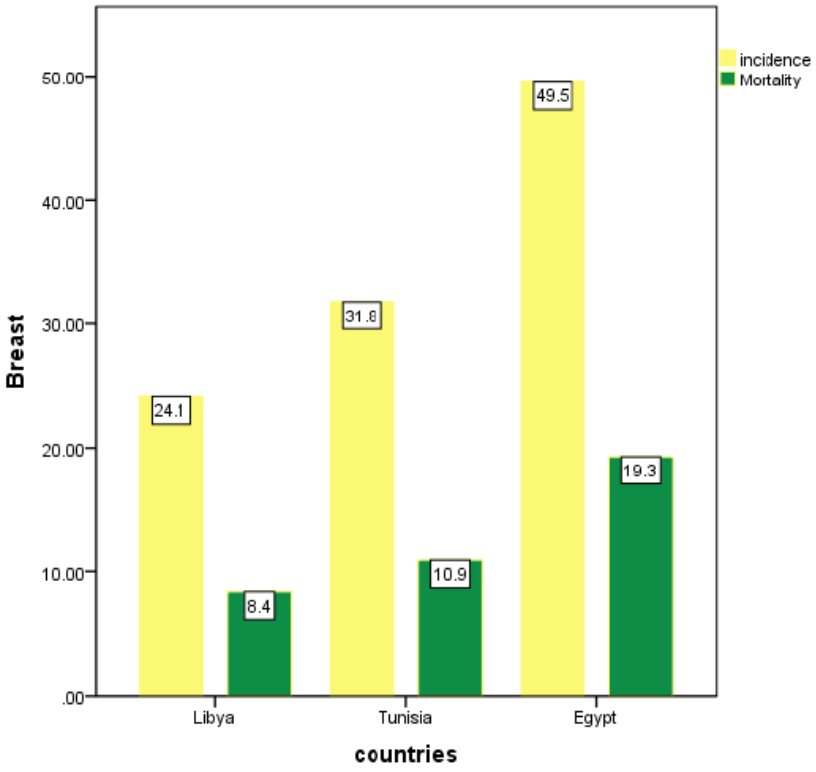

Figure 4.12: Breast ASR of female incidence and of all countries

- **Colorectal**

Figure 4.13 shows the results of ASR estimated of female incidence and mortality by colorectal cancer in Libya, Tunisia and Egypt 2015. The highest value recorded was Libya in both incidence and mortality followed by Tunisia and lowest values were Egypt.

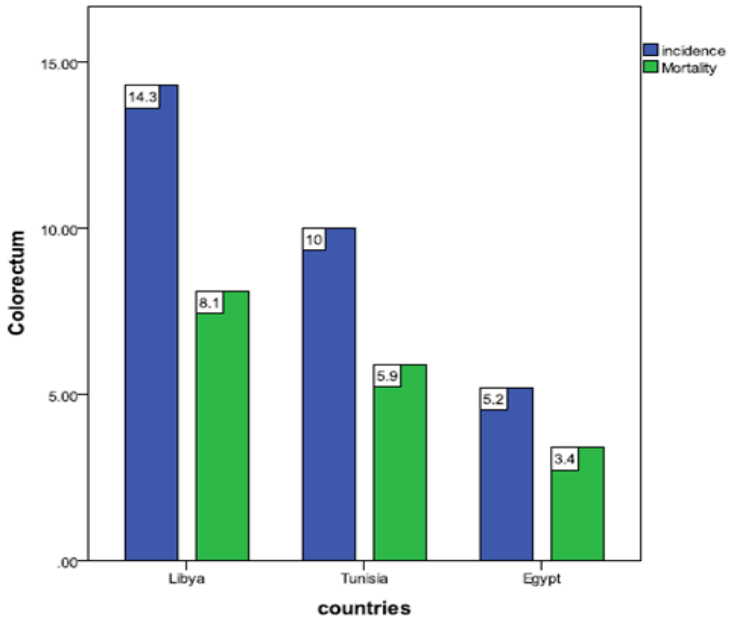

Figure 4.13: Colorectal ASR of female incidence and mortality of all countries

- **Lung**

Figure 4.14 shows the results of ASR estimated of female incidence and mortality by Lung cancer in Libya, Tunisia and Egypt 2015. The highest value recorded was Libya in both incidence and mortality followed by Egypt in close proportions in between incidence and mortality and lowest values were Tunisia.

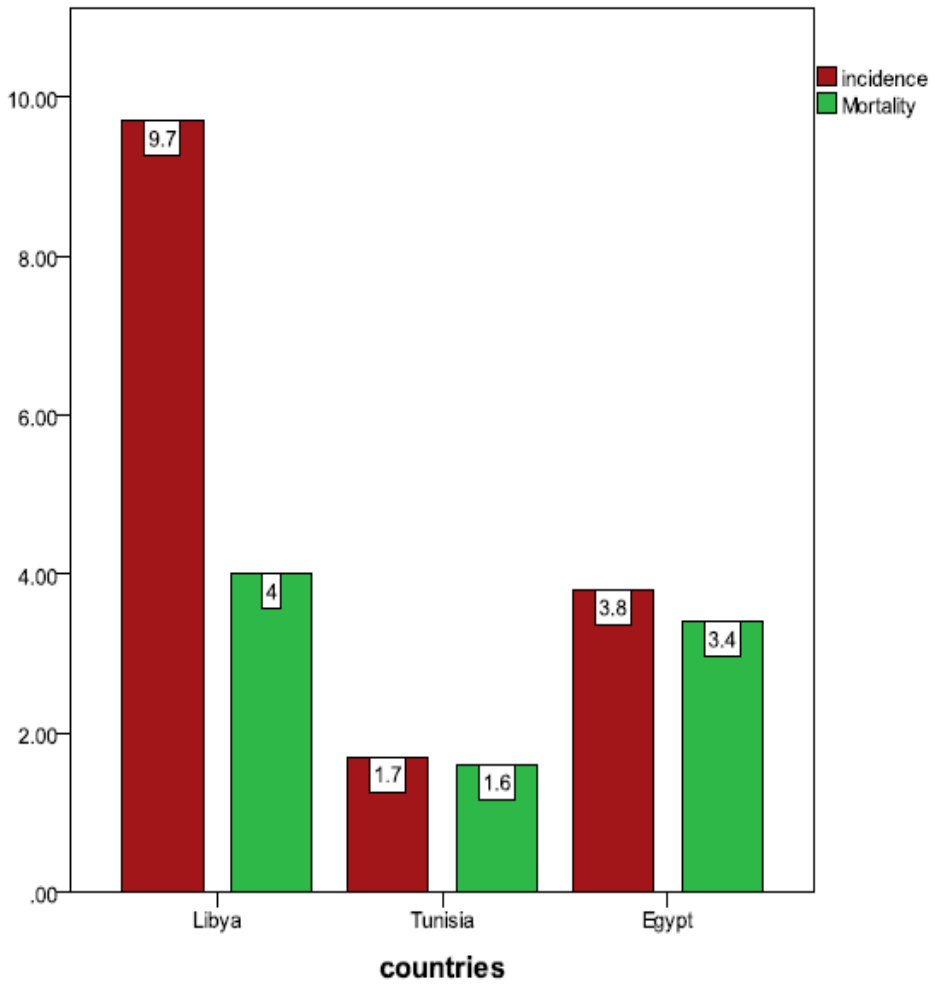

Figure 4.14: Liver ASR of female incidence and mortality of all countries

- **Liver**

The results of ASR estimated of female incidence and mortality by Liver cancer in Libya, Tunisia and Egypt 2015 has been shown in Figure 4.15. As liver cancer, Egypt recorded the highest ASR values with a big difference with the nearest competitor, which is Libya in both incidence and mortality, lowest values were Tunisia with a small percentage between incidence and mortality.

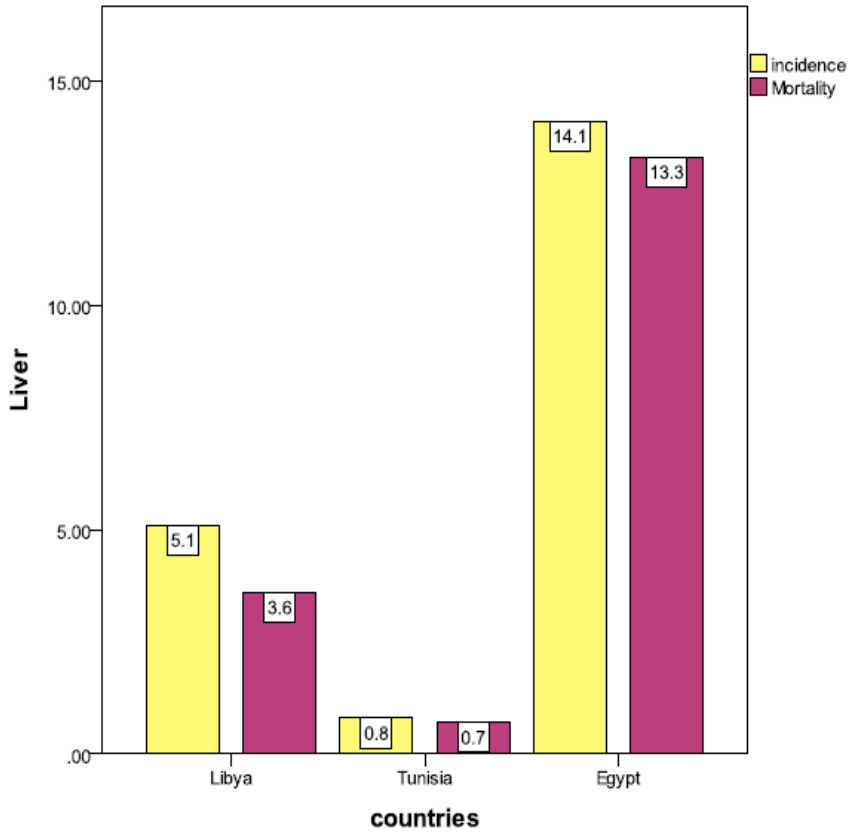

Figure 4.15: Liver ASR of female incidence and mortality of all countries

- **Bladder**

Figure 4.16 shows the results of ASR estimated of female incidence and mortality by bladder cancer in Libya, Tunisia and Egypt 2015. Where Egypt comes as highest ASR values followed by Libya as second ASR in both incidence and mortality, where the lowest values were Tunisia with a big difference with the nearest.

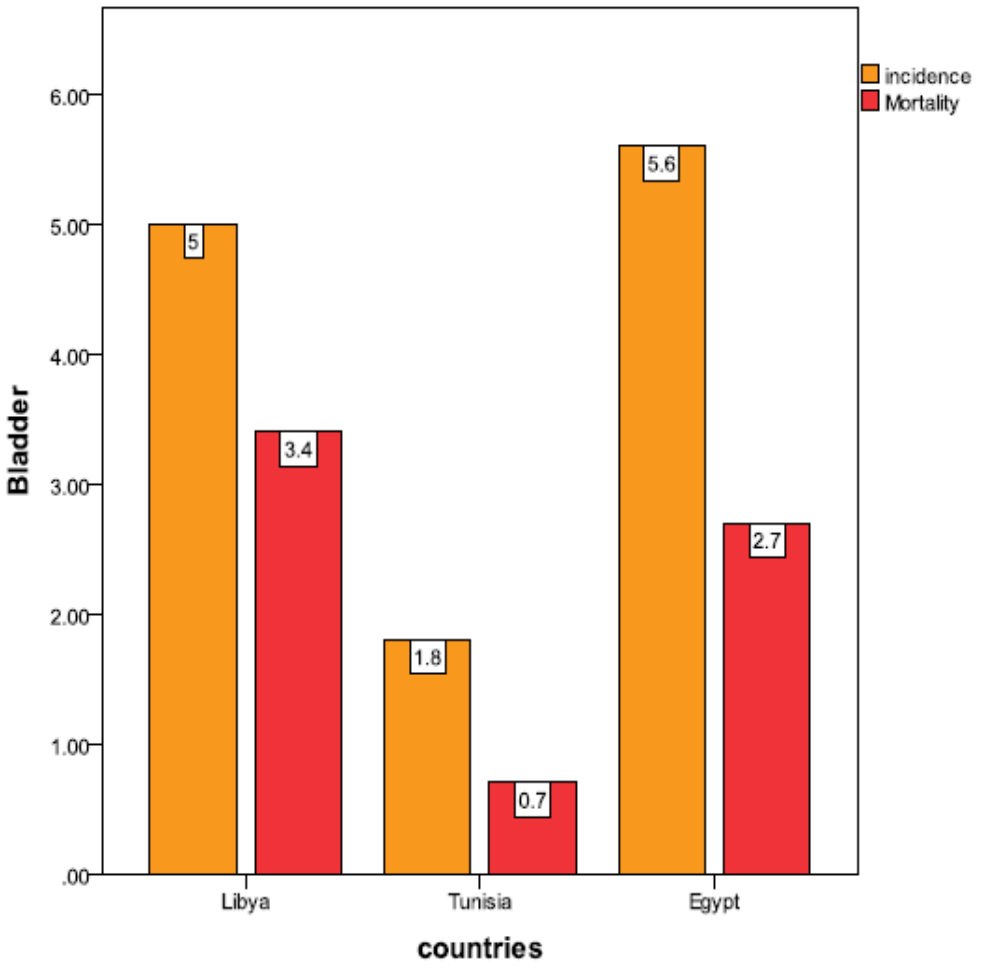

Figure 4.16: Bladder ASR of female incidence and mortality of all countries

4.1.3.3 For both sexes

- **Colorectum cancer**

The estimated age-standardized incidence and mortality rates of both sexes Colorectum cancer shown in Figure 4.17. where figure display gradation in results, the highest ASR values recorded by Libyan incidence and mortality while the lowest were the Egyptian.

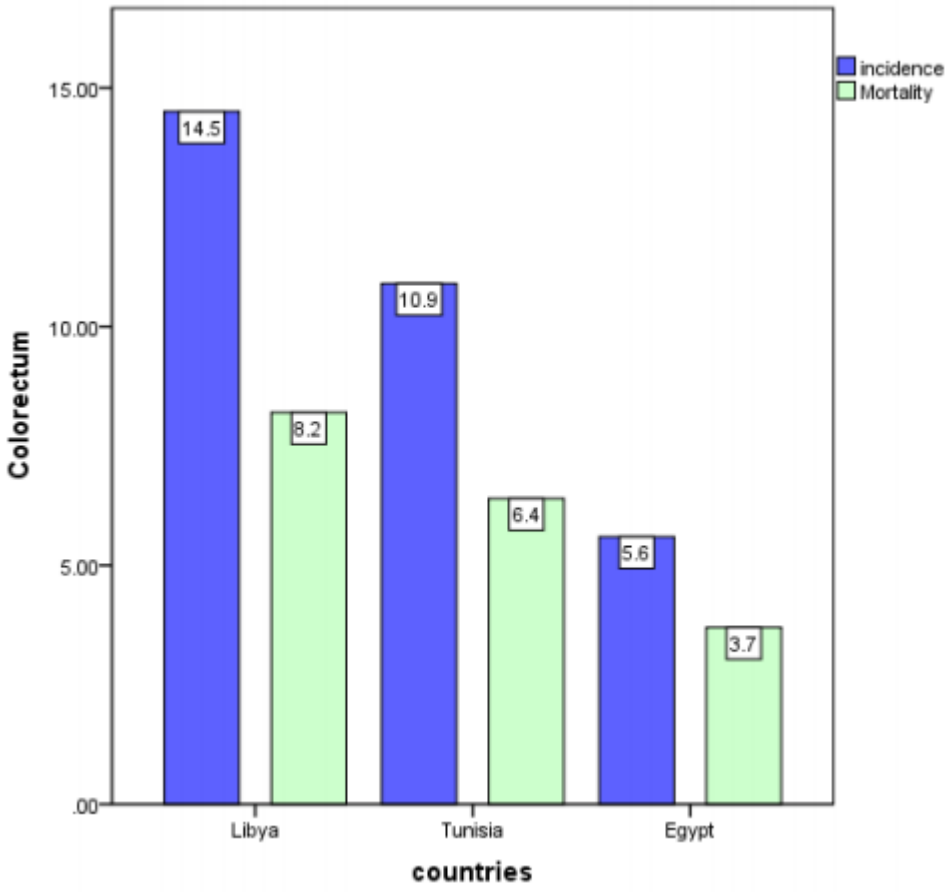

Figure 4.17: Colorectum ASR incidence and mortality rates of both sexes

- **Liver cancer**

Figure 4.18 shows the estimated age-standardized incidence and mortality rates by liver cancer of both sexes. The Egyptian recorded the highest ASR values with a big difference with the Libyan and Tunisian. The Tunisian came with lowest incidence and mortality ASR values.

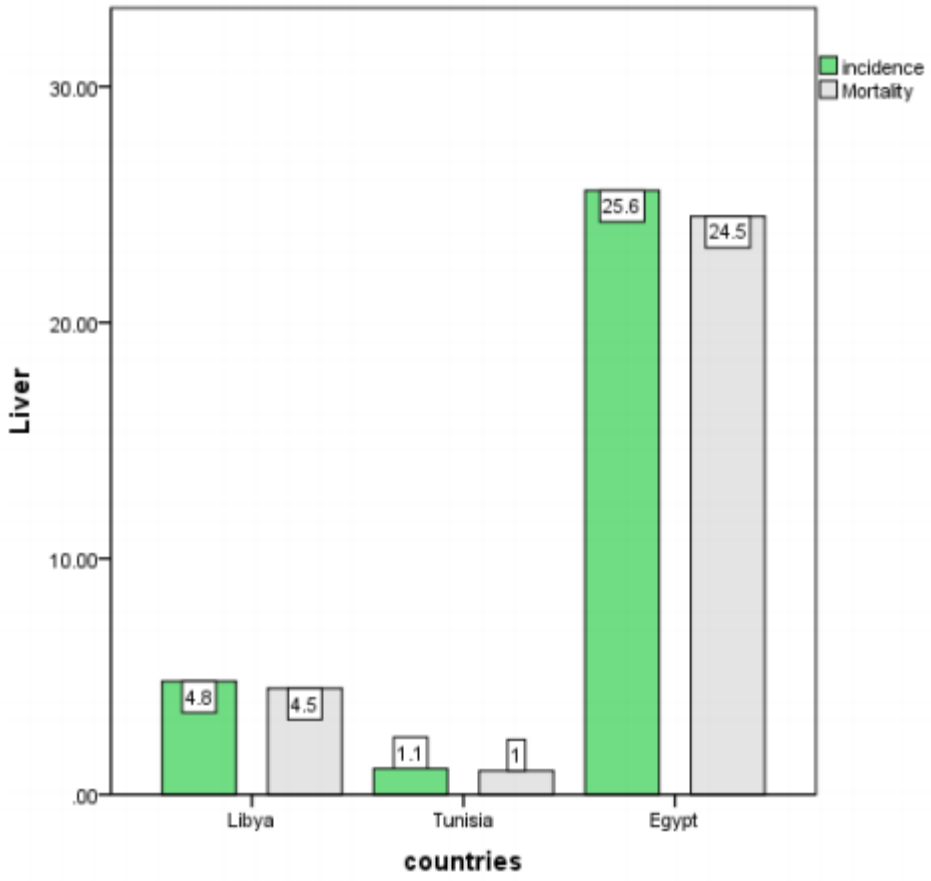

Figure 4.18: Liver ASR incidence and mortality rates both sexes

- **Lung cancer**

Convergence of incidence and mortality ASR results between Libyan and Tunisian both sexes, while the lowest ASR incidence and mortality were by Egyptian. The Estimated age-standardized incidence and mortality rates by lung cancer of both sexes has been shown in Figure 4.19.

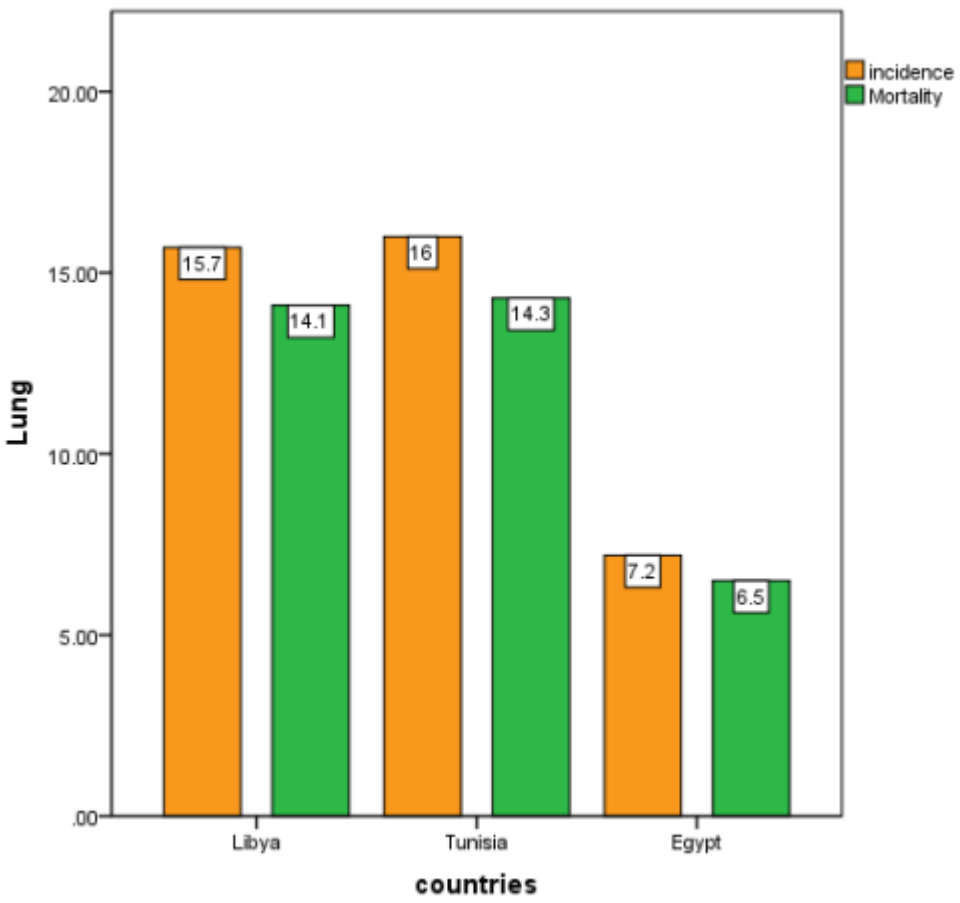

Figure 4.19: Lung ASR incidence and mortality rates of both sexes

- **Prostate cancer**

Figure 4.20 shows the estimated age-standardized incidence and mortality rates of both sexes Colorectum cancer. It can be noted the gradation in results where the highest ASR values recorded by Libyan incidence and mortality while the lowest were the Egyptian.

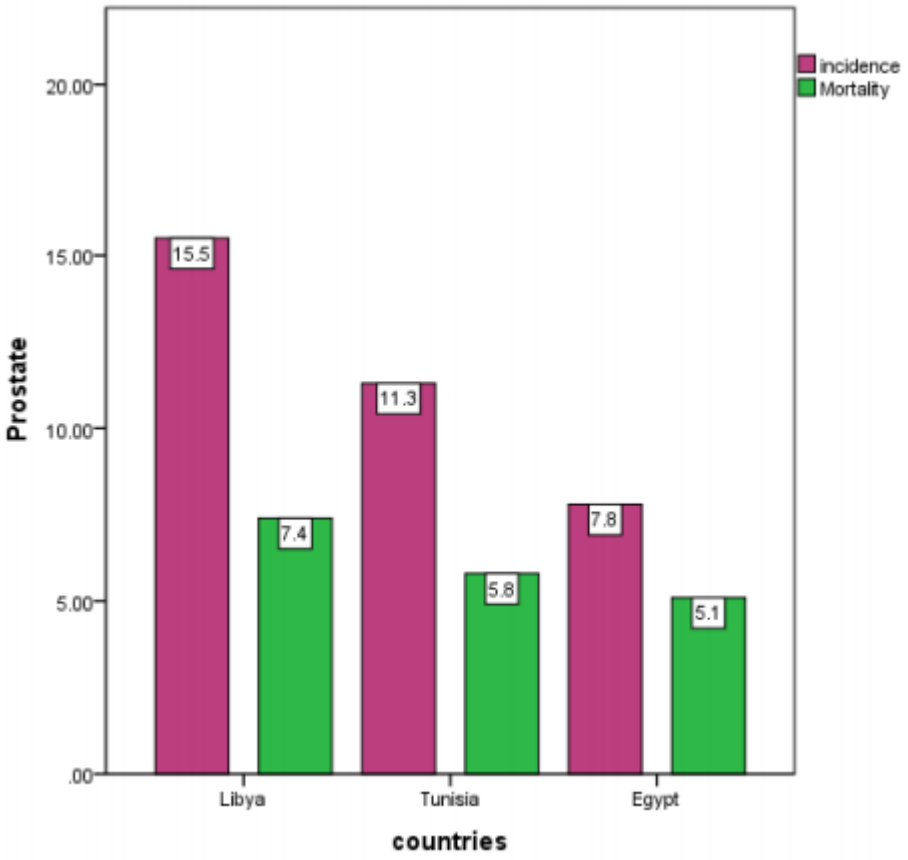

Figure 4.20: Prostate ASR incidence and mortality rates of both sexes

- **Bladder cancer**

Figure 4.21 shows the estimated age-standardized incidence and mortality rates by bladder cancer of both sexes. The highest age-standardized incidence and mortality rates were the Egyptian and Libyan came as second ASR values then the lowest values recorded by Tunisian.

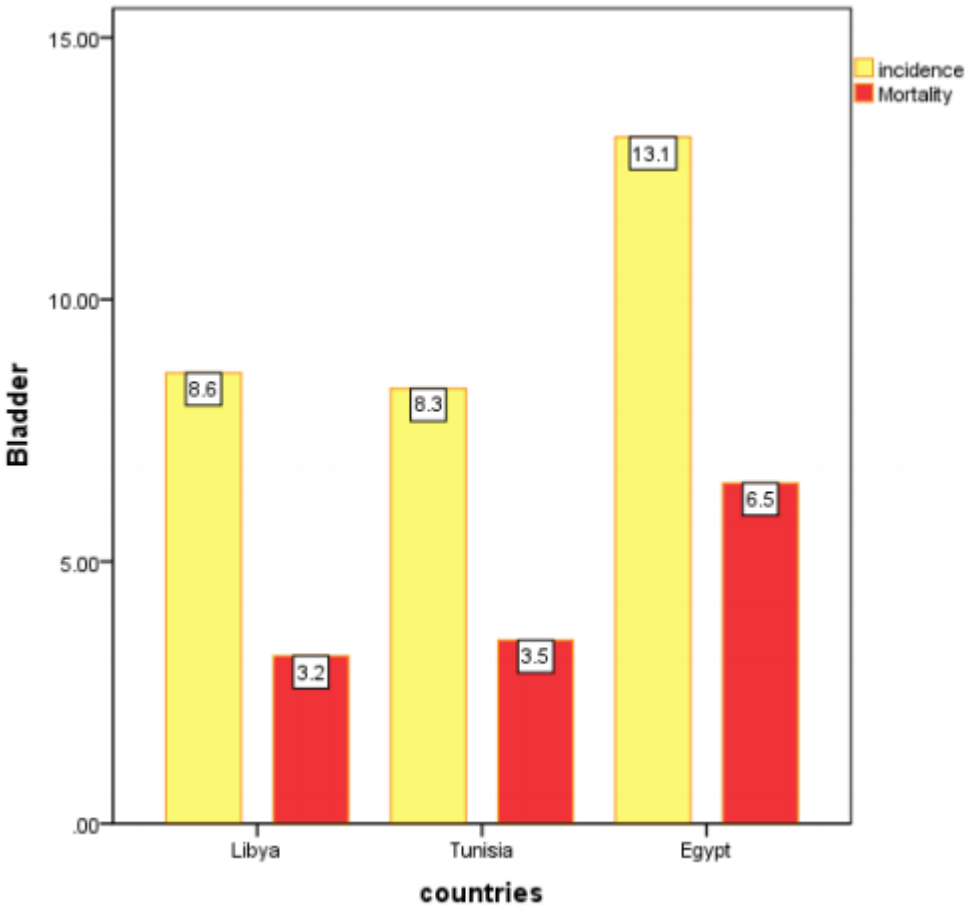

Figure 4.21: Bladder ASR incidence and mortality rates of both sexes

- **Breast cancer**

The breast cancer that recorded by Egyptian became as the highest age-standardized incidence and mortality rates with about 49.5 as incidence with a big difference with the next, which is the Tunisian and in lowest ASR values recorded by Libyan. The estimated age-standardized incidence and mortality rates by breast cancer of both sexes shown in Figure 4.22.

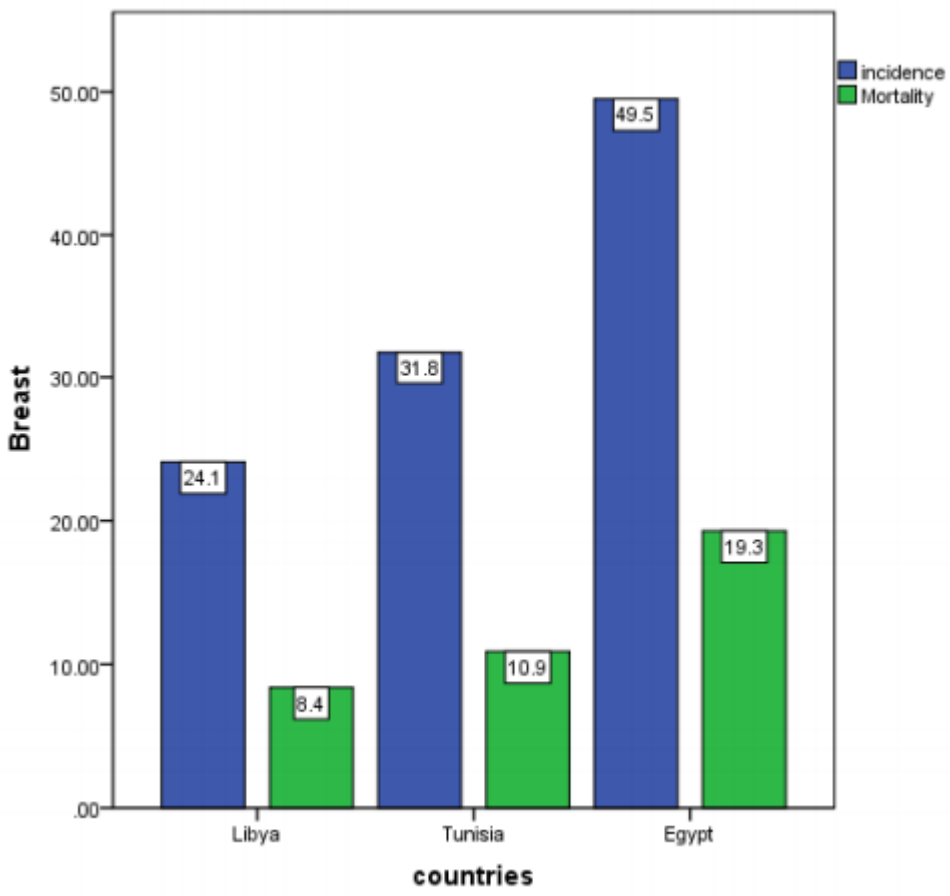

Figure 4.22: The breast ASR incidence and mortality rates of both sexes

4.2 Comparison average & ASR 2015

The Average and Age-Standardized Rate per 100,000 has been calculated for Libya in 2015, as well as Egypt and Tunisia. The calculation was done for male and female, the details are available in Table 4.10. Table 4.11 shows estimated incidence and mortality for both gender.

Table 4.10 shows the difference between Libya and its neighbors in both incidence and mortality for male and female. Where, as male incidence percentage the highest values in Libya was bladder with 19.4 %, followed by 43.3% lung cancer in Tunisia, while the highest male incidence percentage in Egypt was liver cancer with 45.4%. For female, the highest female incidence percentage cancer was breast cancer in all countries Libya, Tunisia and Egypt with 53%, 69.1% and 64.1% respectively. The ASR incidence comparing shows that

the highest Libyan male value was lung cancer with 28, while in Tunisia was lung as well with 31.1. Egypt recorded 38.1 as liver cancer. For female, the ASR incidence comparing shows that the highest value in Libyan female was 24.1 breast cancer, while Tunisian female recorded 31.8 and Egyptian female recorded 49.5, which the highest values in three countries.

The mortality of male and female for all cancer types has been analyzed as well. Where, the highest male mortality percentage in Libya was lung cancer with 48.9%, followed by 55.8% lung cancer in Tunisia, while the highest male mortality percentage in Egypt was liver cancer with 55.6%. For female, as same as incidence, the highest female mortality percentage was breast cancer in all countries Libya, Tunisia and Egypt with 36.4%, 54.6% and 46.1% respectively. The ASR mortality comparing shows that the highest Libyan male value was lung cancer with 25.2, while in Tunisia was lung as well with 27.8. Egypt recorded 37.0 as liver cancer. For female, the ASR mortality comparing shows that the highest value in Libyan female was 8.4 breast cancer, while Tunisian female recorded 10.9 and Egyptian female recorded 19.3, which the highest cancer type values in three countries.

Table 4.10: The incidence and mortality for detail Male and Female

Type of cancer	Libya								Tunisia								Egypt							
	Incidence				Mortality				Incidence				Mortality				Incidence				Mortality			
	Percentages		ASR		Percentages		ASR		Percentages		ASR		Percentages		ASR		Percentages		ASR		Percentages		ASR	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Colorectum	19.2	29	14.6	14.3	16.2	33.8	8.2	8.1	16.8	21.6	11.9	10.0	14.5	29.9	7.1	5.9	7.7	6.7	6.1	5.2	6.4	8.1	4.1	3.4
Liver	7.1	7.3	5.4	5.1	10.1	14.2	5.2	3.6	1.9	1.7	1.4	0.8	2.6	3.5	1.3	0.7	45.4	17.6	38.1	14.1	55.6	31.4	37.0	13.3
Lung	35.3	6.8	28.0	9.7	48.9	12.7	25.2	4.0	43.3	3.7	31.1	1.7	55.8	8.0	27.8	1.6	13.2	4.7	11.2	3.8	15.1	8.0	10.1	3.4
Prostate	19.0	-	15.5	-	13.8	-	7.4	-	16.4	-	11.3	-	13.5	-	5.8	-	8.6	-	7.8	-	7.1	-	5.1	-
Bladder	19.4	3.9	15.3	5.0	11	2.9	5.8	3.4	21.6	3.9	15.3	1.8	13.6	4.0	6.5	0.7	25.1	6.9	21.8	5.6	15.8	6.4	11.1	2.7
Breast	-	53	-	24.1	-	36.4	-	8.4	-	69.1	-	31.8	-	54.6	-	10.9	-	64.1	-	49.5	-	46.1		19.3
Total	**100**	**100**	**78.8**	**58.2**	**100**	**100**	**51.8**	**27.5**	**100**	**100**	**71.0**	**46.1**	**100**	**100**	**48.5**	**19.8**	**100**	**100**	**85.0**	**78.2**	**100**	**100**	**67.4**	**42.1**

Table 4.11: The incidence and mortality for both sexes

Type of cancer	Libya				Tunisia				Egypt			
	Incidence		Mortality		Incidence		Mortality		Incidence		Mortality	
	Percentages	ASR	Percentages	ASR	Percentages	ASR	Percentages	ASR	Percentages	ASR	Percentages	ASR
Colorectum	23.1	14.5	22.4	8.2	18.7	10.9	19.2	6.4	7.2	5.6	7.0	3.7
Liver	23.5	15.7	36.2	14.1	2.2	1.1	2.8	1.0	31.1	25.6	44.9	24.5
Lung	7.2	4.8	11.5	4.5	26.9	16.0	41.3	14.3	8.9	7.2	13.2	6.5
Prostate	10.9	15.5	8.9	7.4	9.6	11.3	9.4	5.8	4.2	7.8	4.0	5.1
Bladder	12.8	8.6	8.2	3.2	14.3	8.3	10.7	3.5	15.7	13.1	11.7	6.5
Breast	22.5	24.1	12.8	8.4	28.3	31.8	16.6	10.9	32.9	49.5	19.2	19.3
Total	**100**	**83.2**	**100.0**	**45.8**	**100.0**	**79.4**	**100.0**	**41.9**	**100.0**	**108.8**	**100.0**	**65.6**

4.3 Hypothesis testing

The last thing to compare will be P- values .the P- values is used from the two the tests One Way ANOVA test and One sample T test , to find out the difference in Mean of ASR results .

P –Values are used to indicate the statistical significance in a hypothesis test.

The P – Value or the calculated probability, is used in a hypothesis to support or reject the null hypothesis. The P – value is an evidence against a null hypothesis. The smaller the P – value the strong the evidence that the null hypothesis must be rejected.

- **The null hypothesis , H_0**

The null hypothesis is a hypothesis of the no difference.

In the thesis in one sample T test, the null hypothesis is there is no different in the Mean of ASR results in different type of cancer. Either in the one-way ANOVA test; the null hypothesis is there is no different in the ASR results in three countries.

- **The alternative hypothesis , H_1**

The alternative hypothesis is the opposite of the null hypothesis. A hypothesis that you try to investigate .In the thesis, in one sample T test the alternative hypothesis is there is there is difference in the Mean of ASR results in different type of cancer .Either in one-way ANOVA test the alternative hypothesis is there a difference in the ASR results in three countries.

The Alpha levels are related with the confidence levels and determined by the researchers before the test has been started Alpha levels have been calculated by subtracting the confidence level by 100% for Example ,if you want to have a confidence level to be 97% in your research. Then the alpha level will be 100% – 97% = 3%. When you run the hypothesis test, the test will give you a value for P. Compare that value to your chosen alpha level. In this thesis, an alpha level has been chosen as 5% (0.05).

Therefore, the followings will identify the results of this thesis

1. A small P (<=0.05), reject the null hypothesis.

2. A large P (>0.05) means the alternate hypothesis is weak, so you do not reject the null hypothesis.

4.3.1 One – way anova test

We conducted the ONE WAY ANOVA test on the rate of injury for both Males and females separately, as well as mortality rates for both Males and females, by using the null hypothesis and the alternative hypothesis the results were as in the following table:

H_0: The ASR results are the same in three countries

H_1: The ASR results are different in three countries

Table 4.12: Mean of ASR result in three countries

Case	Gender	F test	P- value
Incidence	Female	0.302	0.745
	Male	0.238	0.792
Mortality	Female	0.956	0.412
	Male	0.175	0.812

The table presents data regarding age-standardized ratios by both sex and compared with three countries. It can clearly be seen of age-standardized ratio that the p value are grader than 0.05, which the null hypothesis (H_0) is accepted.

4.3.2 One – sample t- test

The ONE SAMPAL T-Test was conducted on the rate of infection of each country for both males and females separately it was also conducted on the mortality rate for each country, both for males and females using the null hypothesis and the alternative hypothesis the results were as follows:-

H_0: The mean of ASR results is the same in different type of cancer

H_1: The mean of ASR results is different in different type of cancer

Table 4.13: Mean of ASR result by different type of cancer

Case	Countries	Gender	Mean	Std.Deviation	T test	P- value
Incidence	Libya	Female	6.000	4.786	2.803	**0.049**
		Male	15.760	8.043	4.381	**0.012**
	Tunisia	Female	9.220	13.162	1.566	0.192
		Male	12.200	12.272	2.223	0.090
	Egypt	Female	15.640	19.360	1.807	0.145
		Male	17.000	13.279	2.863	**0.046**
Mortality	Libya	Female	4.900	3.269	3.351	**0.029**
		Male	10.440	8.359	2.799	**0.049**
	Tunisia	Female	3.960	4.437	1.996	0.117
		Male	4.580	10.422	2.055	0.109
	Egypt	Female	8.420	7.505	2.509	0.066
		Male	13.480	13.495	2.234	0.089

The tables provide information of age-standardized ratios by different type of cancer for both gender compared with each countries. The most striking feature is that the mean of age-standardized ratio in Tunisia and Egypt are not significant. Whereas in Libya there is different, age-standardized ratios by different type of cancer in both gender and shows significant in male Egypt. On other hand, in mortality case, all countries show insignificant except Libya is significant in both sex.

CHAPTER 5

CONCLUSION

5.1 Conclusion

This research aims to explain the cancer incidence in Libya relative to neighboring countries with spotting the light on the distribution of cancer and its spatial patterns in the study area as well as the awareness of the spatial conditions of countries to reduce cancer. The main objective is to urge the state on such subjects that were lacking in our country and developing countries in general. From this point of view, the importance of this research comes from its title. Where this type of studies appears to be a new area that most researchers and statisticians seek to explain the relationship between statistical studies, the geographical environment and human health, as well as the emergence of diseases and their high rates. The main conclusion from the research and statistical work are drawn as following:

1. This study to estimated of the cancer incidence in Libya and comparison with neighboring countries in 2015.
2. All kinds of cancer for both gender has been analyzed as percentage and ASR for incidence and mortality.
3. For male, the highest common cancer rate in Libya and Tunisia was for Lung cancer, while in Egypt for Liver cancer.
4. For female, Breast cancer was the most common for the three countries.
5. Using One Way ANOVA, the ASR results for the incidence and mortality rate of three countries for both males and females were equal, with no difference.
6. Using One Sample T-Test, the mean of ASR results for the incidence and mortality rate for both males and females in Libya were different for all cancers types.
7. In Egypt, the mean of ASR results for males were different in all cancers types, while for females there was no difference. In addition , there was no difference for the mortality rates for males and females.
8. The mean of ASR results of Tunisia of incidence rate and the mortality rate for both males and females was the same for all types of cancer.

9. The most striking feature is that the mean of age-standardized ratio in Tunisia and Egypt are not significant. Whereas in Libya there is different age standardized ratios by different type of cancer.

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