UNIVERSITY OF NAMIBIA

FACULTY OF AGRICULTURE AND NATURAL RESOUCES

FISHERIES AND AQUATIC SCIENCE

Relationship between fish consumption and cardiovascular diseases in Omaheke and Caprivi region (2002-2008).

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Submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Science in Fisheries and Aquatic sciences

Research Project Report

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Declaration

"I hereby declare that this work is a product of my own research efforts, undertaken under the supervision of Mr. A Samakupa (Relationship between the level of fish consumption and cardiovascular diseases in Caprivi and Omaheke region) and has not been presented elsewhere for the award of a degree or a certificate. All sources have been duly and appropriately acknowledged"

Names……………………………………………

Student #...

Signature…………………………………………...

Date…………………………………………………..

Certification

This is to certify that this report has been examined and approved for the award of the degree of Bachelor of Science in Fisheries and Aquatic Sciences of the University of Namibia.

External Examiner…………………..   Date……………….

Internal Examiner…………………...   Date……………….

Supervisor…………………………..   Date……………….

Head of Department………………..   Date………………

Acknowledgement

First and foremost I would like to thank God for granting me such an opportunity to be studying at the University of Namibia. I acknowledge the department of fisheries and Aquatic Sciences for the funding of the project and all the necessary assistance. My special thanks and appreciation to my supervisor Mr A Samakupa, who despite his other serious engagement devoted his time in guiding me through my project.

I would also like to thank the ministry of health and social services staff in both Caprivi and Omaheke region for being able to help me with the data i needed for my study.

Dedication

Dedicated to my beloved parents, my friends and family for their unconditional support.

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Abstract

The regular intake of fish meals comes with great benefits to the human body, one of such benefits is the reduction in the chances of suffering from cardiovascular related diseases. There are three most common cardiovascular related diseases in Omaheke and Caprivi namely; coronary heart disease (heart attack), cerebrovascular disease (stroke), and raised blood pressure (Hypertension). This study was carried out to access the level of fish consumption compared to the mortality rates due to cardiovascular diseases in Caprivi and Omaheke region. It is believed that people in Caprivi region consume more fish than any other region in Namibia where as, fish consumption in Omaheke region is believed to be the lowest in the country as it is a meat based region. The results show that the mortality rates due to the three cardiovascular related illnesses are high in Omaheke region where fish consumption is low and low mortality rates in Caprivi region where fish consumption is high. However, the T-test for comparison of two independent samples was used to compare the mortality rates of the two regions and the results shows that there is no significant difference between the rates of the two regions as figures for Omaheke are just slightly higher than those of Caprivi. The fish level is very much high in Caprivi compared to Omaheke which explains why mortality rates are lower in Caprivi, therefore the regular intake of fish meals in a week might really reduce the chances of getting cardiovascular diseases.

INTRODUCTION

1.1 Introduction

Namibia is a country rich in fisheries resources due to the Benguella current but fish consumption has been reported to be very low since independence. Fish consumption is believed to be high in the north and north eastern parts of Namibia; this is mainly because of the floodplains and the bordering rivers such as Zambezi and Kavango. Traditionally, people in Caprivi and Kavango consume fish on a daily basis compared to other regions like Omaheke where meat is more preferred than fish. Africa has not been spared from this global tide of cardiovascular diseases (CVD), in most African countries CVD is now the second most common cause of death after infectious disease, accounting for 11 percent of total deaths (WHO, 1999). This study will look at the relationship between cardiovascular diseases (CVD) and fish consumption, what the regular intake of fish could do to the much rising cardiovascular diseases. A research will be conducted as to compare the level of fish consumption in two regions found in Namibia. Namely; Caprivi where it is believed that fish consumption is very high compared to Omaheke region where fish consumption is low.

1.2 Literature review

1.2.1 Advantages of consuming fish

The regular consumption of fish is very important in reducing the risk of various diseases and disorders. Fish is important in the diets and livelihoods of many poor people suffering from vitamin and mineral deficiencies. According to (Yesuf et al, 1991), children who eat fish may be less likely to develop asthma. Fish rich in omega 3 fatty acids can also contribute to the health of brain tissue as well as improvement on eye sight. Breastfed babies of mothers who eat fish have better eyesight, perhaps due to the omega 3 fatty acids transmitted in breast milk.

The omega 3 fatty acids in fish may also reduce the risk of many types of cancers by 30 to 50 per cent, eating fish every week reduces the risk of heart disease and stroke by reducing blood clots and inflammation, improving blood vessel elasticity, lowering blood pressure, lowering blood fats and boosting 'good' cholesterol. In elderly people, those who eat fish or seafood at least once a week may have a lower risk of developing dementia, including Alzheimer (Bird & Miller, 2005). People who regularly eat fish have a lower incidence of depression which is linked to low levels of omega 3 fatty acids in the brain. Fish may help people with diabetes manage their blood sugar level. Surprising enough, eating fish during pregnancy may help reduce the risk of delivering a premature baby.

Fish is a good source of protein and, unlike fatty meat products; it's not high in saturated fat. Fish is also a good source of omega-3 fatty acids which benefit the heart of healthy people, and those at high risk of or who have cardiovascular diseases. Research has shown that omega-3 fatty acids decrease risk of arrhythmias (abnormal heartbeats), which can lead to sudden death. Omega-3 fatty acids also decrease triglyceride levels, slow growth rate of atherosclerotic plaque, and lower blood pressure. Fatty fish like salmon, mackerel, herring, lake trout, sardines and albacore tuna are high in omega-3 fatty acids. Some types of fish may contain high levels of mercury, PCBs (polychlorinated biphenyls), dioxins and other environmental contaminants. Levels of these substances are generally highest in older, larger, predatory fish and marine mammals. The benefits and risks of eating fish vary depending on a person's stage of life (WHO, 2001).

Fish is low-fat and is a good quality of protein, filled with vitamins like riboflavin (Vitamin B2), which aids the body in the metabolism of amino acids, fatty acids, and carbohydrates and Vitamin D, which aids calcium absorption to help prevent osteoporosis. Fish is also rich in calcium and phosphorus and a great source of minerals, such as iron, zinc, potassium (a mineral needed for muscles, nerves, and fluid balance in the body), iodine, and magnesium. When people substitute meat for fish, they decrease their intake of these essential vitamins, minerals, and Omega-3 fatty acids. There is also evidence that fish is beneficial for developing the fetal and infant brain (Conner et al, 1990).

While it is recommended to eat one to two fish meals a week, it is wise to avoid fish high in mercury. Excess mercury appears to affect the nervous system, causing: numb or tingling fingers, lips and toes; developmental delays in walking and talking in children; muscle and joint pain; increased risk of heart attack. Fish high in mercury include shark, swordfish (broadbill) and marlin, ray, gem fish, ling, orange roughy (sea perch) and southern blue fin tuna. Pregnant women, nursing mothers, women planning pregnancy and children up to six years old should avoid these fish, (Van Gelder et al, 2007).

1.2.2 More on Cardiovascular diseases

Cardiovascular disease is the class of diseases that involve the heart or blood vessels (arteries and veins). While the term technically refers to any disease that affects the cardiovascular system , it is usually used to refer to those related to arterial diseases. Cardiovascular diseases are the world's largest killers, claiming 17.1 million lives a year. Tobacco use, an unhealthy diet, physical inactivity and harmful use of alcohol increase the risk of heart attacks and strokes (Maton, Anthea 1993).

Cardiovascular disease is caused by disorders of the heart and blood vessels, and includes coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure. The major causes of cardiovascular disease are tobacco use, physical inactivity, and an unhealthy diet.

1.2.3 Cardiovascular diseases in developed & developing countries

The burden of cardiovascular diseases in the world is enormous and growing, and the majority of those affected are in developing countries (Beaglehole and Yach 2003). In 2002 it was estimated that 29% of deaths were due to cardiovascular diseases (WHO 2002). Furthermore, 78% of global mortality from CVD occurs in developing countries (Murray and Lopez 1996). Many developing countries are known to be very rich in fish resources, these resources play an important role in the diets, livelihoods, and income of many poor population groups who suffer from vitamin and mineral deficiencies. Usually, the benefits derived from fish are not well documented and can be grossly underestimated.

It is well accepted that fish are a good source of animal protein; however, their role as a source of vitamins and minerals in developing countries is often overlooked. Thus, quantification of the nutritional contribution from fish in poor, rural households is necessary to assess the role fish can play in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. The vitamin A, calcium, iron, and zinc contents of commonly consumed fish species, nutrient bioavailability, and the contribution of these fish to the intakes of these essential, limiting nutrients are described (Iso et al, 2006).

Although the mortality rate of cardiovascular diseases and prevalence of major cardiovascular risk factors has generally decreased in economically developed countries, the corresponding mortality rate and risk prevalence has substantially increased in China, other East Asian societies and now India, which have been undergoing rapid demographic, social and economic changes. Dietary and lifestyle changes associated with economic growth and increasing wealth have led to a marked increase in obesity and diabetes in Asia that may further increase the burden of cardiovascular diseases. In sub-Saharan Africa, where infectious diseases remain the leading cause of death, hypertension and stroke are emerging as an important cause of ill health in the rapidly urbanizing population of the region (Beydoun et al, 2007).

1.2.4 Fish consumption in Namibia

Despite the abundance of marine fisheries resources of the country, fish consumption in Namibia is among the lowest in Africa, estimated at 14.2 per caput per year (MFMR, 2007). Fishing represents Namibia's second largest foreign currency export earner, (after mining): 90% of the national fisheries output is exported. Fisheries contributed approximately 10.1 per cent (representing about N$1.477 billion) in 1998 to Gross Domestic Product (GDP). Namibia beats all African countries, and globally is among the top 10 fishing countries, with respect to value production (MFMR, 2007).

Fish has not been part of the traditional diet of many Namibians which is meat based. However, the Namibia Fish Consumption Trust has been established by the Ministry of Fisheries and Marine Resources with the objective of increasing domestic fish consumption. Fish is one of the cheapest forms of protein available; however fish comprises only about 10% of total animal protein intake except for in the northern region in the Caprivi floodplains, where fish is more important in the diet. In Kavango and Caprivi Region more than 100,000 people depend on this resource for their daily protein needs (MFMR, 2007). Freshwater fish consumption in the Caprivi Region ranks over beef, game and poultry and also has a significant economic value for the communities.

The domestic market for marine fish products is extremely limited due to the small size of the population (2 million). In addition, the traditional diet in Namibia is meat based. It is estimated that only 10% of Namibian fish is consumed in the local market. The main fish species dominant in the domestic markets are horse mackerel, small size hake (baby hake) snoek and dentex fish. Horse mackerel is particularly popular because it is cheaper compared to other fish products and easily available. Inland fish, on the other hand, are marketed closer to the area of production and in very limited quantities (MFMR, 2007).

1.2.5 Related studies

According to (Oksman et al, 2007), intake of tuna fish plus other types of fish can limit the risks of dementia in old people. The study was done on 3600 men and women not younger than 65 years old, the results of which had shown that old people who eat tuna or other types of fishes, that are rich in omega-3 fatty acids, at least three times weekly had 26% lower risk

of the incidence of brain tissue scars leading to dementia and brain clots when compared to old people who do not eat fish regularly (Oksman et al, 2006).

Another study was done on white men and women in 1987–89 with analyses of plasma fatty acids in cholesterol esters and phospholipids. Three neuropsychological tests were given at baseline and again between 1990 and 1992 and between 1996 and 1998 (Söderberg et al, 2001). The risk of decreased global cognition was greater with higher concentrations of palmitic acid and arachidonic acid in both cholesterol esters and phospholipids. Along with numerous previous studies, this study provide the rationale for a future clinical trial of fish, fish oil, or both in elderly patients prone to the development of Alzheimer disease. This disease is devastating both to the afflicted person and to that person's family. Capable persons become helpless and must be cared for by the family and by the community (Schaefer et al, 2006)

This common problem of aging will expand in the near future because people are living longer. It is estimated that 20–40% of the population now over the age of 85 may have Alzheimer disease. A further daunting statistic is that, once Alzheimer disease is identified as the cause of cognitive decline, the patient may live for many years with a high yearly cost of care (Schaefer et al, 2006). There are potential and safe measures that would prevent this disease; Fish and fish oil containing 2 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) may have promise. The major dietary sources of these 2 fatty acids are fish and shellfish, from both salt water and fresh water.

1.3 Statement of the problem

How can the regular consumption of fish reduce the risk of much rising cardiovascular disease? Fish intake should be at least two to three times a week but that has not been the case in most parts of the world including Namibia. Fish consumption is not only important for proteins but for prevention of many disorders and diseases such as cardiovascular as well.

1.4 Rationale

The burden of cardiovascular diseases in the world is enormous and growing, thus there is a need of alternative solutions such as fish consumption to reduce the risk of people getting the diseases. This research project aims at providing information on the benefits of consuming

fish, such as reduction of cardiovascular diseases. The reduction in mortality due to cardiovascular diseases is one of the objectives of this research project. The results of this project will convince people to consume fish more often.

1.5 Hypothesis

Ho: There is no significant difference in the number of deaths between regions where fish consumption is high and where it is low.

Hi: There is a significant difference in the number of deaths between regions where fish consumption is high and where it is low.

CHAPTER TWO

METHODOLOGY

The research is a comparison between two regions in Namibia, Caprivi region in the eastern part of the country and Omaheke region in the East. Data on the number of people who have died due to cardiovascular diseases (Hypertension, Stroke and Heart failure) was collected from the health facilities of each region. Fifty people were interviewed in a form of a questioner to look at the level of fish consumption compared to the level of beef consumption in each region. The survey period was from 15 August to 29 August 2010, the target group were the people who live in the central part of each region. The survey contained of 10 questions that covered 7 topics; type of fish mostly consumed, frequency of fish meals taken per week compared to beef, awareness of the importance of consuming fish, access areas of the fish, how the fish is prepared, most common cardiovascular diseases and how fish consumption has been increasing.

2.1 Area under study

2.1.1 Caprivi region

This Region is one of 13 political regions in the Government of the Republic of Namibia, with Katima Mulilo being the capital of the region. Katima Mulilo is located on the banks of the Zambezi river where most of the people survive as subsistence farmers selling fish. Caprivi region is a stretch of land (popularly known as the **"**arm" of Namibia) situated in the North Eastern of the country. According to the census carried out in 2001, Caprivi region covers an area of about 19,532 Km with a population of 79,826. The Caprivi region borders with the following neighbouring countries**;** Botswana in the East and South , Zimbabwe in the North East , Zambia in the North and Angola in the North West. It also borders with Kavango Region in Namibia in the West. Caprivi region is the only region in Namibia known to be rich in fresh water resources thus known for its abundance in fish.

Figure 1. Map of Caprivi region
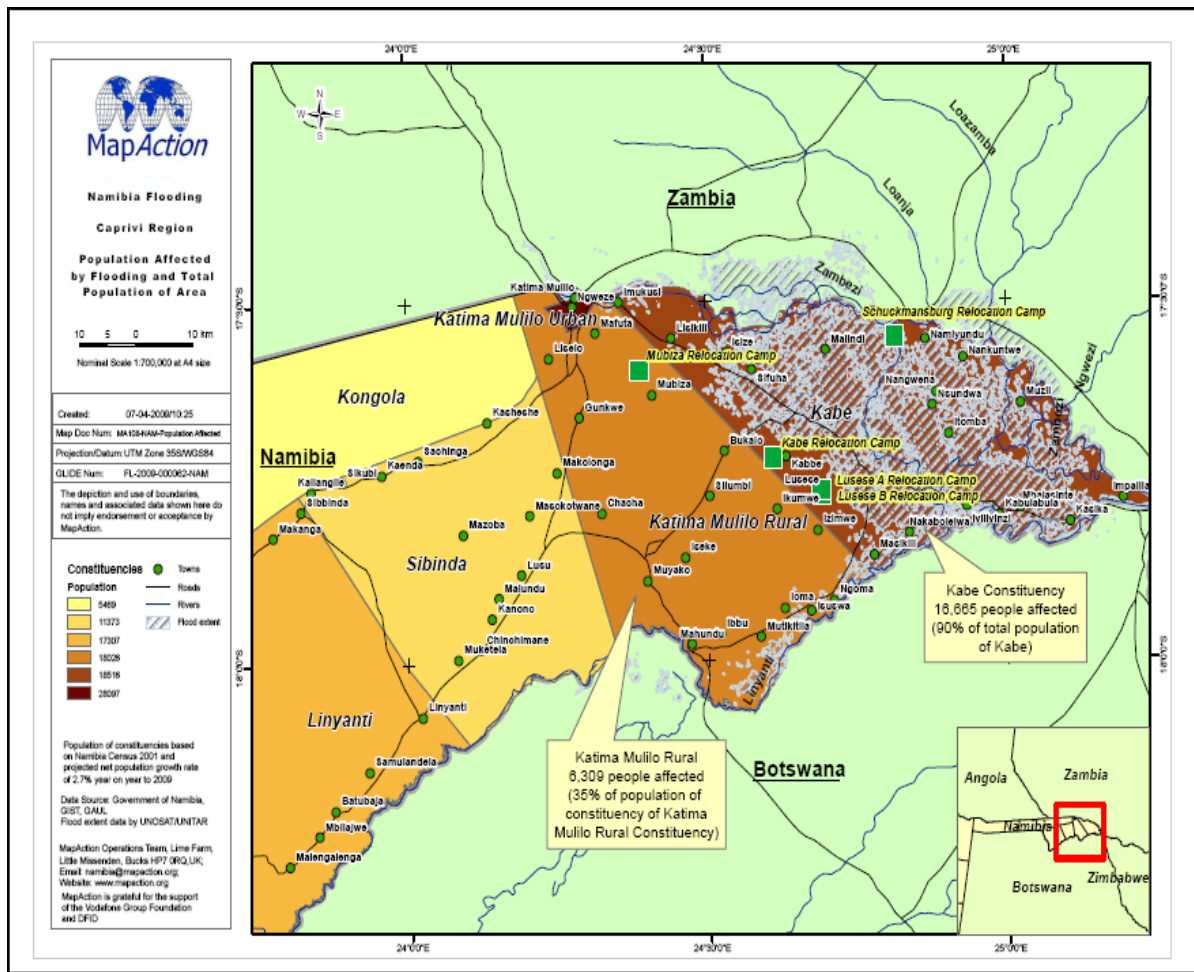
Source: *WWW.alertnet.org/thefacts/satelite/1239109784.htm*

2.1.2 Omaheke region

Omaheke Region is situated in the eastern part of Namibia, it lies on the eastern border of Namibia bordering Botswana. Gobabis is the capital of the region, it covers an area of 84,732 Km with a population of 84,732. Unlike in the Caprivi region, fish is always absent in the meals of the people living in Omaheke. Most communal farmers in this area are cattle breeders and it is also known as a cattle country.

Figure 5. Map of Omaheke region

Source: *http://www.go2africa.com/namibia/omaheke-region/map*

2.2 Most common fish consumed in Caprivi

Figure 2. Tilapia (*Oreochromis andersonii*)

Figure 3. Cat fish *(Clarias gariepinus)*

Figure 4 . Canned fish

2.3 Statistical analysis

The data that was collected in this research is numeric data (qualitative data) which involves real numbers that can be manipulated using arithmetic operations (i.e. addition, subtraction, multiplication and division) to produce meaningful results. T-test for comparison of independent means will be the statistical analysis that will be used to test the hypothesis.

The number of people who died due to Cardiovascular diseases, most common ones being; raised blood pressure (Hypertension), Coronary heart disease (Heart failure) and Cerebrovascular disease (stroke) were collected from the health facilities of each region.

Table 1.Caprivi region mortality rates and cases

Year	Diseases					
	Hypertension		Heart failure		Stroke	
	Cases	Death	Cases	Death	Cases	Death
2002	88	3	32	2	4	4
2003	147	5	26	2	6	2
2004	112	0	19	3	4	0
2005	81	3	14	1	14	4
2006	108	1	46	1	6	2
2007	118	6	23	5	6	4
2008	33	2	47	1	5	5

The table above shows that hypertension has the most reported cases from 2002 to 2008 and stroke has the lowest reported cases in Caprivi region. The table also shows the most deaths are caused by hypertension, hence Hypertension has the highest cases reported as well as number of deaths.

Table 2. Omaheke region mortality rates and cases

Year	Diseases					
	Hypertension		Heart failure		Stroke	
	Cases	Death	Cases	Death	Cases	Death
2002	64	4	153	2	100	2
2003	60	2	260	13	230	3
2004	26	2	235	8	166	1
2005	75	6	54	2	11	0
2006	42	4	166	9	333	6
2007	61	3	181	6	288	10
2008	41	1	153	4	3	0

The table above consists of the data collected from Omaheke region, it includes cases and number of deaths due to three most common cardiovascular diseases in that region with the highest cases and deaths due to stroke and hypertension being the lowest in both cases and number of deaths.
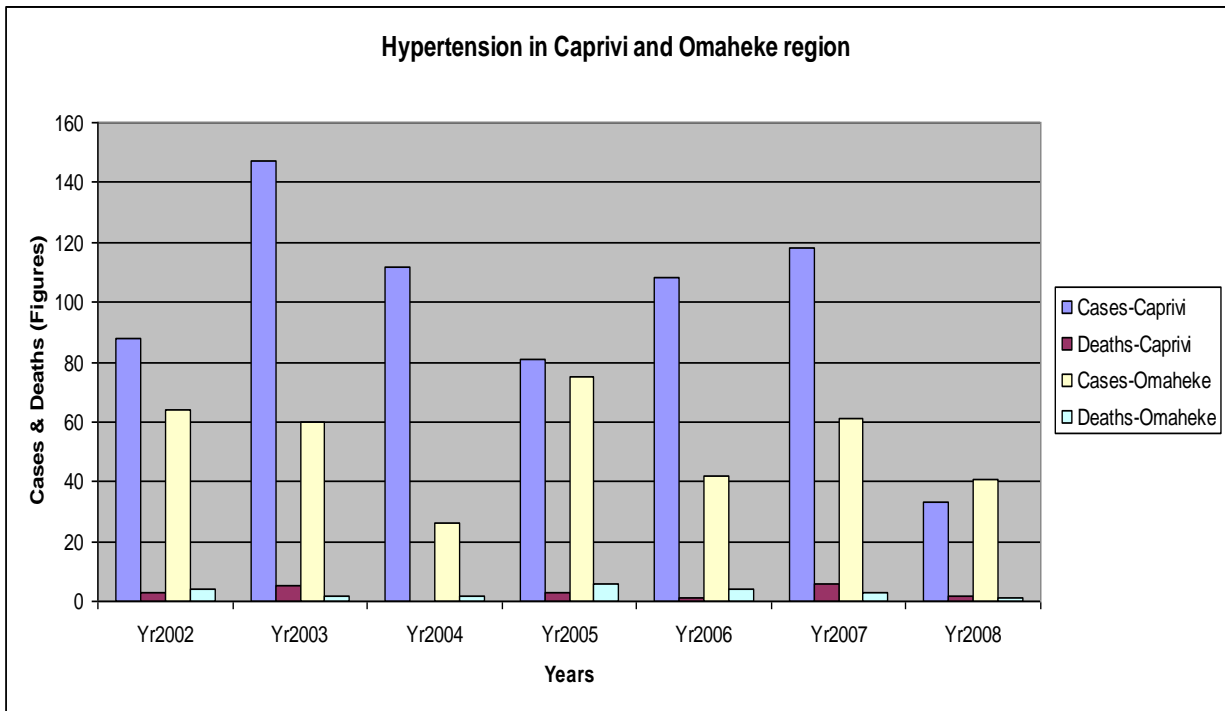
Figure 6

The graph above shows that cases of hypertension in Caprivi are higher than those in Omaheke region through out the period under study but the number of death due to hypertension in Omaheke are higher than the deaths in Caprivi.
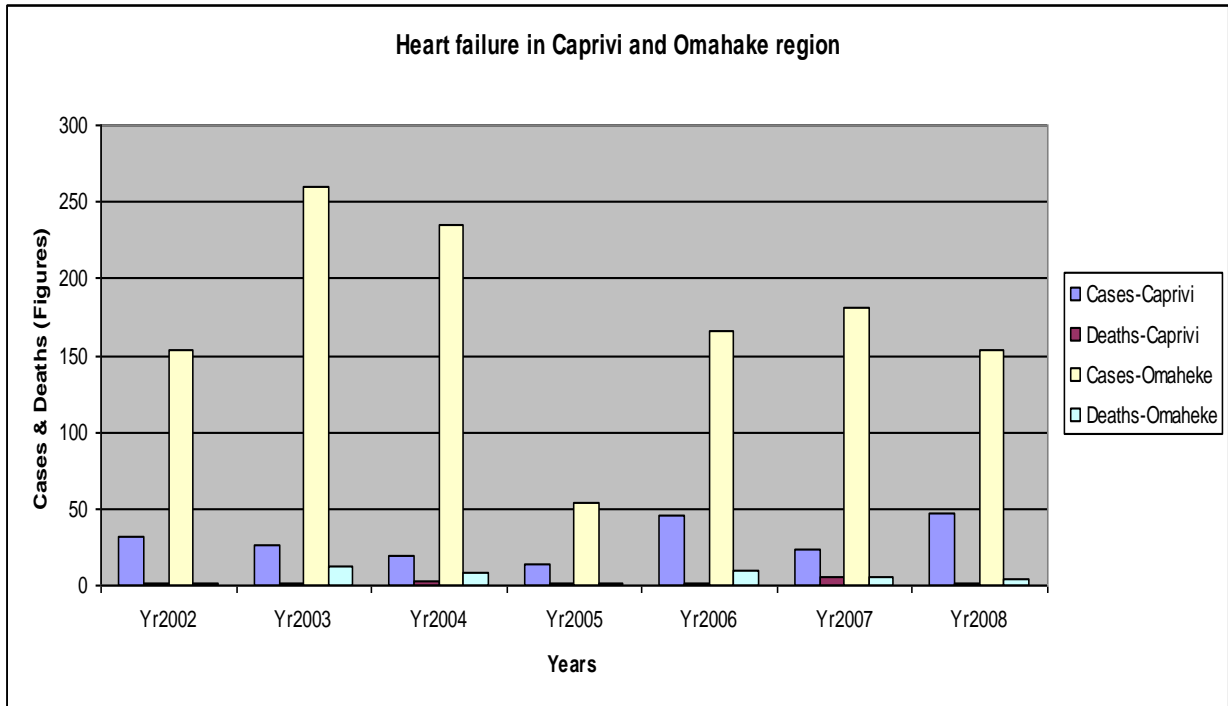
Heart failure in Caprivi and Omahake region

Figure 7

The graph above shows the variance in the number of deaths due to heart failure for both Caprivi and Omaheke region, Omaheke being relatively high. However cases due to heart failure are very high in Omaheke than in Caprivi region.
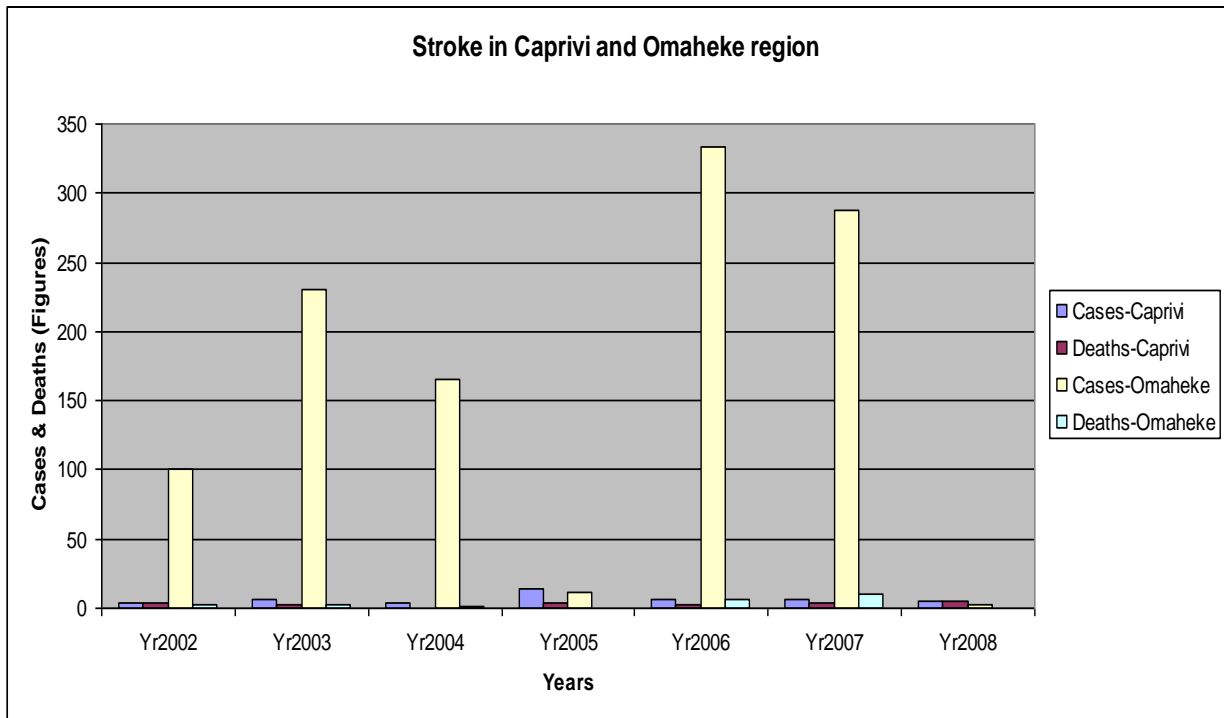
.

Figure 8

The graph above indicates that the cases due to stroke are very high in Omaheke compared to Caprivi region, with a higher record in the year 2006. Furthermore, the deaths due to stroke vary from year to year during the period under study with an insignificant difference on aggregate in both regions.

The survey questions and responds for Caprivi region

1. Do you eat fish?

    i) No   **4%**

    ii)Yes   **96%**

1. a) If yes, what type of fish?

    i) Tilapia   **74%**

    ii) Cat fish   **16%**

    iii) Any type of canned fish   **10%**

    b) If no, why?

    i) Expensive   **0%**

    ii) Allergic   **2%**

    iii) Not available   **0%**

    iv) Not interested   **2%**

2. How many times do you eat fish in a week?

    i) 0-3   **4%**

    ii) 4-7   **22%**

    iii) 8-11   **68%**

    iv) 12-14   **6%**

3. Are you aware of the importance of consuming fish?

    i) No   **32%**

    ii) Yes   **68%**

4. How do you access fish? Through the,

      i) Open market   **72%**

      ii) Supermarket   **10%**

      iii) Vendors   **16%**

      iv) Direct from the river   **0%**

5. How do you prepare the fish?

      i) Boil   **22%**

      ii) Fry   **76%**

      iv) Roast   **2%**

6. Has anyone suffered from any disease related to cardiovascular in your family?

      i) Yes   **56%**

      ii) No   **44%**

6. a) if yes, what type of disease

      i) Coronary heart disease (heart attacks) **5.0%**

      ii) Cerebrovascular disease (stroke)   **28%**

      iii) Raised blood pressure (hypertension) **67%**

7. What are the other types of food that you eat?

     i) Beef   **9%**

     ii) Milk   **0%**

     iii) Chicken   **82%**

     iv) Vegetables   **0%**

8. How many times do you eat beef in a week?

   i) 0-3   **26%**

   ii) 4-**7**   **74%**

   iii) 8-11   **0%**

   iv) 12-14   **0%**

9. Looking back at previous years how is the level of fish consumption?

   i) Increased   **100%**

   ii) Decreased   **0%**

10. By estimation, How much?   **At least 30%**

Survey questions and responds for Omaheke region

   1. Do you eat fish?
      i) No   **2.0%**
      ii)Yes   **98%**

1. a) If yes, what type of fish?

     i) Tilapia   **42%**

     ii) Cat fish   **6.0%**

     iii) Any type of canned fish   **52%**

   b) If no, why?

     i) Expensive   **0%**

     ii) Allergic   **0%**

     iii) Not available   **0%**

iv) Not interested   **2.0%**

2. How many times do you eat fish in a week?

    i) 0-3   **100%**

    ii) 4-7   **0%**

    iii) 8-11   **0%**

    iv) 12-14   **0%**

3. Are you aware of the importance of consuming fish?

    i) No   **0%**

    ii) Yes   **100 %**

4. How do you access fish? Through the,

    i) Open market   **4.0%**

    ii) Supermarket   **96%**

    iii) Vendors   **0%**

    iv) Direct from the river   **0%**

5. How do you prepare the fish?

    i) Boil   **0%**

    ii) Fry   **100%**

    iv) Roast   **0%**

6. Has anyone suffered from any disease related to cardiovascular in your family?

    i) Yes   **64%**

    ii) No   **36%**

6. a) if yes, what type of disease

    i) Coronary heart disease (heart attacks),   **9.375%**

    ii) Cerebrovascular disease (stroke)   **9.375%**

    iii) Raised blood pressure (hypertension)   **81.25%**

7. What are the other types of food that you eat?

    i) Beef   **64%**

    ii) Milk   **0%**

    iii) Chicken   **20%**

    iv) Vegetables   **16%**

8. How many times do you eat beef in a week?

    i) 0-3   **10%**

    ii) 4-7   **26%**

    iii) 8-11   **10%**

    iv) 12-14   **54%**

9. Looking back at previous years how is the level of fish consumption?

    i) Increased   **100%**

    ii) Decreased   **0%**

10. By estimation, How much?   **50%**

1. The most common fish consumed
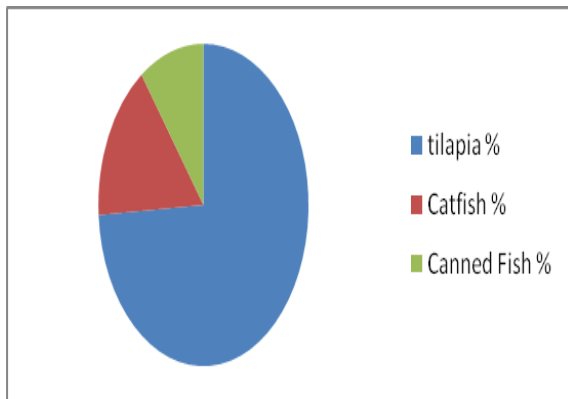
Figure 9. Caprivi region
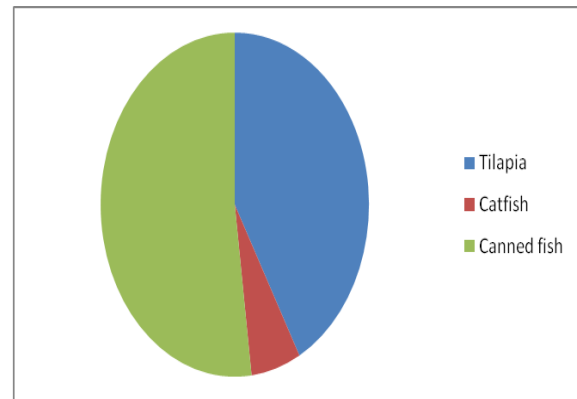
Figure 10. Omaheke region

According to the findings of the survey, about 74% of the population surveyed in Caprivi consume tilapia more often than catfish and canned fish and this is dipcted by figure 9 above. Figure 10 above shows that about 52% of the population surveyed in Omaheke region consume canned fish more often, followed by Tilapia which is 42% and then catfish with just a small percentage of 6.
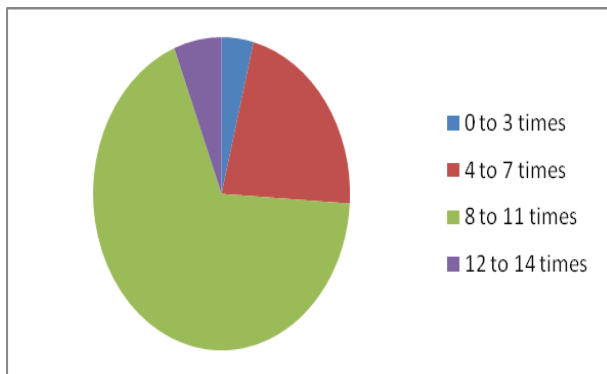
2. Frequency of fish meals

Figure 11. Caprivi region
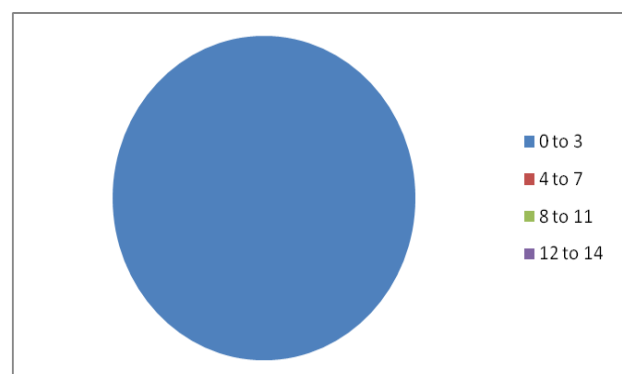
Figure 12. Omaheke region

The findings of the survey also revealed that, about 68% of the population surveyed in Caprivi region take 8-11 fish meals in a week and this is shown by figure 11 above. On the other hand, figure 12 shows that 100% of the population surveyed in Omaheke region only take between 0-3 fish meals in a week and none take fish meals more than 3 times in a week.
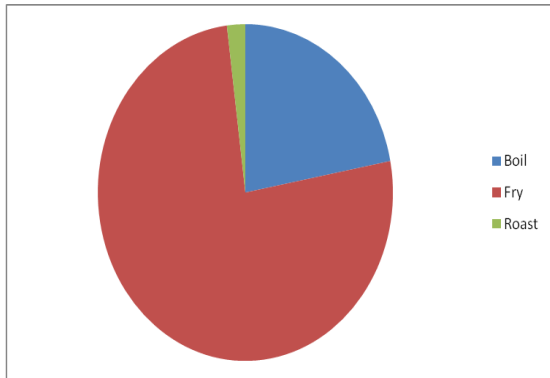
3. Methods of preparing the fish meals
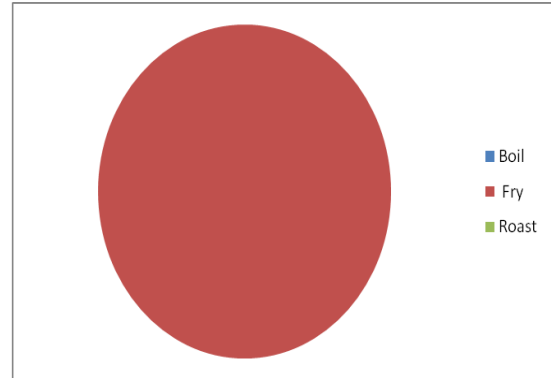

Figure 13. Caprivi region

Figure 14. Omaheke region

About 76% of the population surveyed in Caprivi prepare their fish meals by frying, followed by boiling and roasting which is only 2%. This is illustred in figure 13 above, figure 14 shows that 100% of the population surveyed in Omaheke prepare their fish meals through frying and none prepare their fish through boiling and roasting.

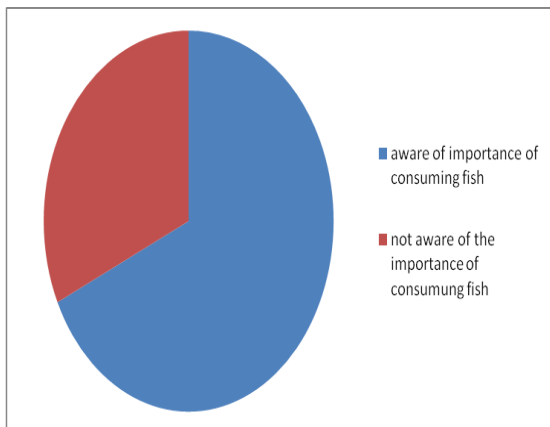### 4. Awareness of the brnefits of fish consumption
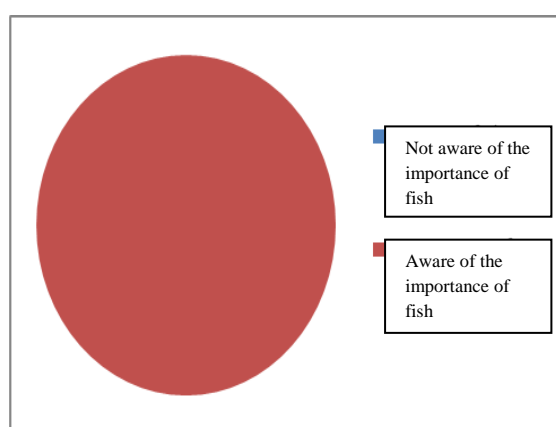

Figure 15. Caprivi region

Figure 16. Omaheke region

The pie chart in figure 15 above shows that 68% of the population surveyed in Caprivi are aware of the benefits that come with fish consumption and 32% are not aware of the benefits. In Omaheke, 100% of the population surveyed are aware of the benefits of consuming fish more often which is illustreted by figure 16 above.

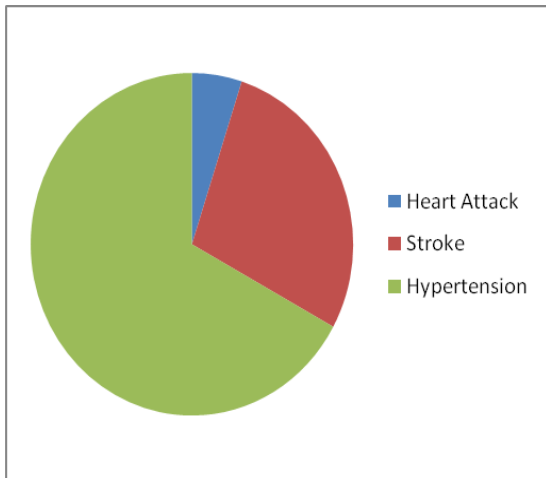**5. Most common cardiovascular diseases**

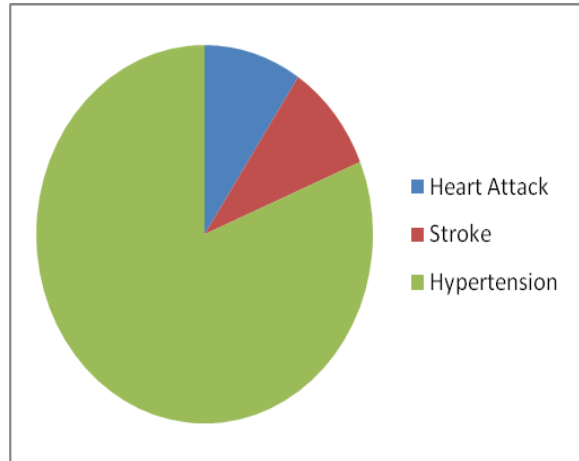Figure 17. Caprivi region   Figure 18. Omaheke region

There three most common Cardiovascular diseases in both Omaheke and Caprivi region, with hypertension being the highest in both regions. However, hypertension takes about 80% in Omaheke which is way more than the hypertension in Caprivi shown by figure 17.

CHAPTER 4

4.1 DISCUSSIONS

The current study involved a survey of people living in Caprivi and Omaheke regions to compare mortality rates due to cardiovascular diseases. Moreover it was the purpose of the current study to determine if there is any relationship between fish consumption as well as the occurrence or absence of cardiovascular diseases in both regions. The frequency of fish consumption compared to beef from both regions was compared to the mortality rates due to Cardiovascular diseases such as Coronary heart disease, cerebrovascular disease and raised blood pressure.

This study was done for the purpose of improving the delivery of the fish consumption message and to show the relationship between the regular intake of fish and cardiovascular diseases because, according to (Morris et al, 1995) there is a significant reduction in the blood pressure of people who eat fish more often due to the Omega-3 fatty acids. A similar study was conducted by (Zhang et al, 1999), where fish consumption was associated with a reduced risk from all-cause, heart disease and stroke mortality across 36 countries.

As indicated in the results, the mortality rates due to hypertension in Omaheke region (3.14) were found to be slightly higher than those of Caprivi region (2.86). This information was compared statistically and it was found that there is no significant difference in hypertension between the two regions. This implies that, Hypertension in Omaheke region is not very high compared to hypertension in Caprivi region. Considering the fact that fish consumption is high in Caprivi region while it is low in Omaheke region, one would expect the mortality rates to be significantly higher in the latter as the region is known to consume red meat as opposed to fish.

The mortality rates due to stroke in Omaheke region (3.14) were also found to be slightly higher than those of Caprivi region (3.0). Therefore, there was no significant difference in stroke between the two regions. However, there is a very big difference in the mortality rates due to heart failure between Omaheke region (6.28) and Caprivi region (2.14). When compared, the results show that there is a significant difference in stroke between Omaheke

and Caprivi region. These results came as expected because people in Caprivi region consume more fish than people in Omaheke region, therefore their mortality rate due to heart failure are low since regular intake of fish reduces the chances of suffering from Cardiovascular diseases such as heart failure.

There is no significant difference in hypertension and stroke between Caprivi and Omaheke due to the method of preparing the fish meals. For instance, in Caprivi almost 86% of the population sampled take at least 8-11 fish meals a week but the mortality rates are still high. This can be due to other contributing factors such as physical inactivity, smoking and other diets (Maton, Anthea 1993), but it is also due to the fact that almost 76% of the population surveyed prepare the fish by frying which is not good because it contains too much saturated fats. Eating too much saturated fat is one of the major risk factors for heart disease (Ma J et al, 1995) .

Most people in Caprivi region depend on fish for their daily livelihood and it is part of their cultural practices. The present study shows that about 68% of the population surveyed take 8-11 fish meals in a week, when compared to the frequency of beef consumption, 74% of the people take 3-4 meals of beef in a week which is very low compared to fish meals taken in a week. This implies that people in Caprivi consume more fish than beef, hence it explains why deaths due cardiovascular diseases in Caprivi region are lower than those of Omaheke region, according to (Stone, 1996) people who eat fish at least weekly have lower Cardiovascular disease mortality rates than those who do not eat fish. In addition, another study done on the Japanese by (Mizushima et al, 1997), reported a dose-response relationship between the frequency of weekly fish intake and reduced CVD risk factors.

The high intake of fish in Caprivi region may be caused by very low prices of fish due to so much competition and beef on the other hand is very expensive so people prefer fish than beef. In Omaheke region, the study shows that about all the people that were surveyed take only between 0-3 fish meals a week where as beef is taken almost everyday of the week. This means that some of the people do not eat fish at all, some just take one fish meal a week which may increase their chances of suffering from cardiovascular related illnesses. The low level in fish consumption may be due to reasons such as availability and because beef consumption is also part of their cultural practices.

As mentioned earlier in the report, fish consumption comes with a lot of benefits. It is a well known fact that fish is a good source of proteins, rich in vitamins and minerals (WHO, 2001). Most people surveyed are aware of the benefits of consuming fish, however not all of them are aware of the fact that regular intake of fish meals reduces the chances of getting cardiovascular diseases (Oomen et al, 2000). Most people in Caprivi region are subsistence farmers that live by fishing along the banks of the Zambezi river, the fish is harvested in large quantities and most of it is sold at Katima Mulilo open market and at lower prices. Due to the large quantity of the fish, some of it is being sold on the street by the street vendors.

 In Omaheke region, majority of the population surveyed consume canned fish which is mostly bought from the supermarket. Most of the people surveyed prepare the fish by frying, only a small percent of the people prepare the fish by boiling and roasting respectively. The study shows that the most common Cardiovascular disease suffered by both people from Omaheke and Caprivi is raised blood pressure (Hypertension) which is very high in Omaheke compared to Caprivi. About 90% of the population surveyed do believe that fish consumption has been increasing in all the regions especially in Omaheke. According to the Namibian Fish Promotion Trust annual report, fish consumption in Namibia has doubled since Independence.

There are two most common types of fresh water fish consumed in Caprivi region namely; tilapia (*Oreochromis andersonii*) and cat fish *(Clarias gariepinus)*. The Caprivi region is well known for its richness in fresh water sources such as the Zambezi river as well as Chobbe river bordering Namibia and Botswana, thus one can understand the high consumption in tilapia and catfish. Even though 90% of the population surveyed consume cat fish and tilapia, the study shows that about 10% 0f people do consume other types of canned fish such as pilchards and tuna from the local supermarkets.

On the other hand, the most common fish consumed in Omaheke region is the canned fish such as tuna and pilchards. Unlike the Caprivi region, Omaheke has no fresh water fish sources like rivers and is a beef based region. However, the study shows that about 40 % 0f the population surveyed consume tilapia fish. One wonders how tilapia has gone as far as Omaheke region, it is all thanks to the Ministry of Fisheries And Marine Resources for increasing aquaculture practices in Namibia with tilapia being the most cultured fish specie in most parts of the Country (MFMR, 2007).

This increment in aquaculture practices has seen the distribution of fresh water fish species such as tilapia in most parts of the country which is accessed through supermarkets such as pick 'n pay and Shoprite. This study shows that other types of fish such as Hake and Horse Mackerel are not mostly consumed in Namibia. This is because of the prices which are very high for the local people to afford.

4.2 Conclusion

This study is a first attempt to evaluate the relationship between fish consumption and cardiovascular related illnesses in Namibia. Generally, regular intake of fish meals is believed to reduce the chances of suffering from cardiovascular diseases. Between the two regions, the study shows that the mortality rates due to cardiovascular diseases are high in Omaheke region and low Caprivi region.

Therefore there is a relationship between the occurrence of cardiovascular diseases and fish consumption level since cardiovascular mortality rates are high when fish consumption is low. The current study shows that people living in Caprivi region consume fish more often than people in Omaheke. Fish consumption has become a very important issue lately, the survey results showed that majority of the surveyed population are aware of the benefits that comes with the consumption of fish at least weekly.

The study also revealed that , methods of preparing the fish meals contributes to the chances of suffering from cardiovascular related illnesses. Therefore, it is advisable to take at least 2-3 fish meals a week while taking into consideration the preparation method as it reduces the chances of getting cardiovascular related diseases.

4.3 Recommendations

As mentioned earlier , cardiovascular diseases are caused by many other factors apart from unhealthy diet. Factors such as tobacco use and physical inactivity but this study has only focused on unhealthy diet, therefore i would like to recommend that in future a detailed study must be conducted where other causes of cardiovascular diseases will be considered in order to obtain reasonable results.

CHAPTER FIVE

REFFERENCES

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CHAPTER 6

APPENDIX

A total of one hundred surveys were completed for this research, half of it completed in each region under study. A letter of concert was composed for the respondents to understand the purpose of the survey.

University of Namibia

Faculty of Agriculture and natural resources

Department of Fisheries and Aquatic sciences

Letter of consent

Purpose, the University of Namibia through the department of fisheries and aquatic sciences is conducting a survey on the people living in Caprivi region to better understand the level of fish consumption related to cardiovascular disease cases in the region. The importance of the survey is to get the link between fish consumption and cardiovascular disease cases and to create awareness of the benefits of consuming fish to the people.

Privacy, names and other identifying information will not be collected with the survey. Therefore all the responses will be anonymous.

Compensation, there will be no any form of compensation for completing the survey questionnaire.

The survey will provide information on:

1. The general demographics of people who consume fish
2. The amount and frequency at which people consume fish
3. The type of fish people like to consume
4. The benefits of consuming fish

The selection process, any one residing in the area of study has an equal chance of being selected to complete the survey questionnaire. The selection process is done randomly using the hat method.

What the selected individual can do, be free to answer or not to answer. The survey will not last for more than 15 minutes. The respondent has the right to stop at any time

Please feel free to ask any questions if you do not understand what you are asked!!!!

Statistical analysis

Mortality rates in Caprivi and Omaheke region

Years	CAPRIVI (High fish consumption)			Omaheke (Low fish consumption)		
	Hypertension	Stroke	Heart Failure	Hypertension	Stroke	Heart Failure
2002	3	4	2	4	2	2
2003	5	2	2	2	3	13
2004	0	0	3	2	1	8
2005	3	4	1	6	0	2
2006	1	2	1	4	6	9
2007	6	4	5	3	10	6
2008	2	5	1	1	0	4
Total	**20**	**21**	**15**	**20**	**22**	**44**

1). Hypothesis testing

- Ho: There is no significant difference in the number of deaths due to hypertension in Caprivi (high level of fish consumption) and Omaheke (low fish consumption).
- H_1: There is a significant difference in the number of deaths due to hypertension in Caprivi and Omaheke.

2). Level of significance $\alpha = 0.05$

3). Test statistic: T – test for comparison of two independent samples

4). Computation

Hypertension (High level of consumption)

$n_1 = 7$

$x_1 = 2.86$

$\sum x_1 = 20$

$\sum x_2 = 84$

$Sd_1 = 2.115$

$S_1 = 4.48$

Hypertension (low level of consumption)

$n_2 = 7$

$x_2 = 3.14$

$\sum x_2 = 22$

$\sum x_2 = 86$

$Sd_2 = 1.676$

$S_2 = 2.84$

S pooled= $\underline{(n-1)S_1 + (n-1)S_2}$ = $\underline{(6 \times 4.48) + 6 (2.81)}$ = 2.28

$\qquad\qquad$ $(n_1 + n_2 {}_{-2})$ $\qquad\qquad\qquad$ 12

S.E.D = $\underline{2 \text{ S pooled}}$ = $\underline{2 \times 2.28}$ = 0.807

$\qquad\qquad$ n $\qquad\qquad$ 7

$t$calculated = $\underline{x_1 - x_2}$ = $\underline{2.86 - 3.14}$ = -0.35 = 0.35

$\qquad\qquad\qquad$ S.E.D $\qquad$ 0.807

5. Critical value

d.f = $(n1 + n2 - 2) = 12$

tcritical (12 d.f ; 5%) = 2.179

tcalculated   = 0.35

5. If tcalculated < tcritical, do not reject Ho

    If tcalculated>tcritical, reject Ho

7. Conclusion: Do not reject Ho, there is no significant difference in the number of deaths due to hypertension in Caprivi where fish consumption is high and Omaheke where fish consumption is low.

Stroke (high fish consumption)

$n_1 = 7$

$x_1 = 3.0$

$\sum x_1 = 21$

$\sum x_2 = 81$

$Sd_1 = 1.732$

$S_1 = 3$

Stroke (low fish consumption)

$n_2 = 7$

$x_2 = 3.14$

$\sum x_2 = 22$

$\sum x_2 = 150$

$Sd_2 = 3.670$

$S_2 = 13.4$

S pooled $= \dfrac{(n-1)S_1 + (n-1)S_2}{(n_1 + n_2 - 2)} = \dfrac{(6 \times 3) + 6(13.4)}{12} = 8.2$

S.E.D $= \dfrac{2 \text{ S pooled}}{n} = \dfrac{2 \times 8.2}{7} = 1.531$

$t$calculated $= \dfrac{x_1 - x_2}{\text{S.E.D}} = \dfrac{3.0 - 3.14}{8.2} = -0.017 = 0.017$

5. Critical value

d.f $= (n1 + n2 - 2) = 12$

$t$critical (12 d.f ; 5%) $= 2.179$

$t$calculated $\qquad = 0.017$

6. If $t$calculated $<$ $t$critical, do not reject Ho

   If $t$calculated $>$ $t$critical, reject Ho

7. Conclusion: Do not reject Ho, there is no significant difference in the number of deaths due to hypertension in Caprivi where fish consumption is high and Omaheke where fish consumption is low.

Heart failure (high fish consumption)

$n_1 = 7$

$x_1 = 2.14$

$\sum x_1 = 15$

$\sum x_2 = 45$

$Sd_1 = 1.463$

$S_1 = 2.14$

Heart failure (low fish consumption)

$n_2 = 7$

$x_2 = 6.28$

$\sum x_1 = 44$

$\sum x_2 = 374$

$Sd_2 = 4.02$

$S_2 = 16.23$

S pooled $= \dfrac{(n-1)S_1 + (n-1)S_2}{(n_1 + n_2 - 2)} = \dfrac{(6 \times 2.14) + 6\,(1.496)}{12} = 1.818$

S.E.D $= \dfrac{2\,S\ \text{pooled}}{n} = \dfrac{2 \times 1.818}{7} = 0.720$

tcalculated $= \dfrac{x_1 - x_2}{S.E.D} = \dfrac{2.14 - 6.28}{0.720} = -0.017 = -5.75 = 5.75$

5. Critical value

d.f = (n1 + n2 − 2) = 12

$t$critical (12 d.f ; 5%) = 2.228

$t$calculated   = 0.720

6.If $t$calculated < $t$critical, do not reject Ho

   If $t$calculated > $t$critical, reject Ho

7. Conclusion: reject Ho, there is a significant difference in the number of deaths due to hypertension in Caprivi where fish consumption is high and Omaheke where fish consumption is low.