

**ASSESSMENT OF KNOWLEDGE OF HISTAMINE FISH
POISONING AMONG HEALTH CARE PERSONNEL AND FISH
CONSUMERS IN DAR ES SALAAM REGION**

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By

Ngwegwe Bulula

**A dissertation Submitted in partial Fulfillment of the Requirements for the
Degree of Master of Hospital and Clinical Pharmacy of Muhimbili University of
Health and Allied Sciences**

Muhimbili University of Health and Allied Sciences

August, 2012

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation titled *Assessment of knowledge of histamine fish poisoning among health care personnel and fish consumers in Dar es Salaam*, in fulfillment of requirements for the Masters Degree in Hospital and Clinical Pharmacy of Muhimbili University of Health and Allied Sciences.

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DEDICATION

To my family who tolerated my absence at home most of the time and for their moral support and encouragements.

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ABBREVIATIONS

AGA	Agha Khan Hospital
A.M.O	Assistant Medical Officer
Bugn	Buguruni
EU	European Union
FAAR	Fish associated allergic reaction
FDA	Food and Drug Administration
HFP	Histamine fish poisoning
HPLC	High Performance Liquid chromatography
H/C	Health Centre
IMTU	International Medical Technological University
IgE	Immunoglobulin E
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
RAST	Radioallergosorbent Test
SEM	Standard Error of the Mean
SPSS	Statistical package for social sciences
TFDA	Tanzania Food and Drug Authority
TMK	Temeke
USFDA	United States Food and Drug Administration

ABSTRACT

Background information

Histamine fish poisoning which is also called scombroid fish poisoning is a mild to moderate form of food poisoning caused by eating spoiled or bacterial contaminated fish after capture or during subsequent handling and storage. Its symptoms are similar to those of fish allergy and because of that most physicians misdiagnose it.

Aims of the study

The objective of the study was to assess knowledge of histamine fish poisoning (HFP) among fish consumers and health care personnel in Dar es Salaam.

Methods

It was a cross sectional design study, utilizing a pre-tested structured questionnaire with pre-set ten questions pertaining to symptoms of HFP for fish consumers and twelve pre-set questions for health personnel. Two hundred and eighty fish consumers and one hundred and five health care personnel were recruited in the study through convenient sampling.

Results

The study showed that majority of fish consumers not aware of HFP, and awareness was found to be 26.6%, male (54.1%) being more aware than female (45.9%). Also, 43.2% fish consumers with age group 26-40 years had higher awareness than other age groups, though awareness was insignificantly associated with sex ($P=0.153$) and age groups ($P=0.153$). Among health care personnel interviewed, awareness was found to be high (60%) and all physicians had awareness while only 17.2% of clinical officers interviewed had awareness of HFP. Awareness among health workers was significantly associated with their medical cadres.

The study also showed that 97.8% of the fish consumers interviewed had low knowledge about HFP and 2.2% had average knowledge. Among health personnel, 28.6% had low knowledge, 57.1% had average knowledge and 14.3% had good knowledge. All clinical officers interviewed for knowledge assessment of HFP expressed low knowledge level, while physicians and residents were the only cadre with good knowledge among health care personnel. Both scombroid and non scombroid fish were listed by respondents being responsible for HFP; mackerel was frequently listed followed by tuna and king fish for scombroid fish, while Nile perch,

Cat fish and Tilapia were frequently listed among the non scombroid. Symptoms that were recorded among the respondents included rashes, diarrhea and skin itching.

Conclusion

There is a need for training healthcare personnel particularly clinical officers who had low knowledge of HFP and work in peripheral health facilities where allergy tests are not done. Training should highlight how to distinguish fish allergy from histamine fish poisoning, to avoid misdiagnosis. This can be achieved by explaining the significance of making recall of previous history of allergic reactions to incriminated food (fish), since lack of previous history of allergic reaction and high attack rates in group out breaks, implies HFP and not fish allergy. Awareness campaign to fish consumers and the general public on HFP should be conducted to advocate the significance of fish handling after catch by fisherman and during processing, sale and storage, through icing and refrigeration.

CHAPTER ONE

1 INTRODUCTION AND LITERATURE REVIEW

Humans eat various fish as a source of nutrients. But some people, when they eat certain fish get various fatal allergic reactions. The body recognizes some components of food as foreign substances and the immune system responds by producing antibodies (IgE) to combat the allergen. The most common allergens include *Proteinous food* (meat, fish, beans, nuts, seafood, milk and eggs), *Plant pollen* (Rye grass, Ragweed, Timothy trees, and Birch trees), and *Insect products* (bee venom, wasp venom, ant venom, cockroach calyx and Dust mites) (Dean et al, 2009).

Exposure to these allergens to susceptible persons will trigger the release of specific antibodies (IgE), which become attached to mast cells and on subsequent exposure the IgE crosslink with the mast cells triggering the release of histamine and other vasoactive mediators that lead to systemic or local anaphylactic reactions. These allergic reactions can affect the whole body or multiple organs. Local anaphylaxis includes hay fever, asthma, rhinitis and atopic dermatitis. Systemic anaphylaxis includes smooth muscles contraction and systemic vasodilatation. These allergic reactions normally mimic the histamine fish poisoning (Anorld and Brown, 1978; Victoria 2005). Histamine fish poisoning (HFP) which is also called scombroid fish poisoning is a mild to moderate form of food poisoning caused by eating spoiled or bacterial contaminated fish after capture or during subsequent handling and storage (Etkind et al, 1987;; Pynar et al, 2005; BC center, 2008;).

It is common in *Scombroidae* and *Scomberosocidae* families, to have very large amounts of histidine (Fig.1) in their muscle tissues which can be broken down to histamine (Fig 2) and other amines by the enzyme histidine decarboxylase that is produced by certain bacteria (Jay 1992; Mlcnerney et al, 1996; Attaran and Probst, 2002). Once histamine is formed it is not destroyed by freezing, cooking, smoking, curing or canning (Etkind et al, 1987; Attaran and Probst 2002; BC center, 2008).

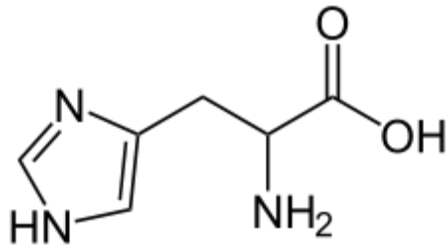


Figure 1: Histidine

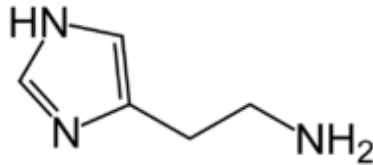


Figure 2: Histamine

Histamine fish poisoning can occur by consuming fresh, frozen or tinned fish products which contain high amounts of histamine ($\geq 0.005\%$ w/w) (*Sapin-Jaloustre and Sapin-Jaloustre 1957; FDA 1996; Lehane and Olley 2000*); Tuna and mackerel, members of the family *Scombroidea*, and sardines tend to have high level of histidine and are therefore more likely to be implicated in allergic reactions (*Wu et al, 1997; Chamberlain, 2001; Victoria 2005*).

Throughout the world, scombroid toxicity is a common illness associated with seafood. For example in North America it ranks among the top four most often reported seafood-borne illnesses. The most common sources within Canada are tuna and smoked mackerel (*BC center 2008*).

Fresh scombroid fishes do not contain histamine; it is formed during storage depending on the temperature. Histamine production stops at 0°C. For example; it was found that the level of histamine was low in mackerel stored at 0°C for 18 days while histamine level was high in mackerel stored at 10°C for only 5 days (*Mitchell, 1993*.) Generally, at a temperature of 4.4°C, the storage life of fishery products is shorter (*Mitchell, 1993; Wu et al, 1997; chamberlain 2001*). For example if Scombroid fish is frozen immediately after catch at 0°C, its storage life will be 14 days, but at 4.4°C, it is only 7 days (*Mitchell 1993*). Since most bacteria cannot grow at temperatures below 4°C, freezing of fishery products during transportation is of great importance.

The optimum temperature and pH values for histamine formation in fish differ from species to species. The optimum temperature range is considered to be between 20-30°C (*Pynar et al 2005*). On the other hand, the optimum pH value needed for

production of histamine from histidine in the bacteria varies even in different species of the same bacteria. For instance type I species of *Proteus morgani* produces more histamine at pH: 6, while there is nearly no histamine produced at pH: 7. However type II species on the other hand produce large quantities of histamine both at pH: 6 and at higher and/or lower pH values (*Wu et al, 1997; Chamberlain, 2001*).

The symptoms of histamine fish poisoning can be very similar to severe allergic reactions and can happen rapidly within ten minutes to four hours of ingestion of the intoxicated fish. These may include; headache, giddiness/dizziness, nausea and vomiting, stomach aches/abdominal cramps, diarrhoea, blushes in the face, swallowing difficulties, low blood pressure, skin itching, body swellings, a burning/tingling sensation in/or around the mouth, rash and/or swelling over the chest/and or neck and diarrhea (*Clifford et al 1989; Mitchell 1993; Hwang et al, 1995; Wu et al, 1997; Kaneko 2000; Lehane and Olley, 2000; Victoria 2005*).

Rapid onset is one of the reasons scombroid poisoning may be reported more often than many other food poisonings which react much slower (*BC Centre 2008*). Most of the fish poisoning symptoms usually last for approximately four to six hours and rarely exceed one to two days (*Gilbert et al, 1980; BC Centre 2008*).

Since symptoms only last a few hours and the condition is rarely life threatening, antihistamines are usually the only necessary drugs to administer. Adrenaline is often given since the diagnosis of fish anaphylaxis cannot be excluded at the outset. Examples of antihistamines available in the market are; cetirizine, celestamine, chlorompheniramine, loratidine, desloratidine, promethazine and corticosteroids.

Prevention from histamine fish poisoning is very challenging. Histamine is neither destroyed by heat or cold. Hence cooking and smoking will not destroy the toxin similarly freezing and canning (*Etkind et al, 1987; BC Centre 2008*).

The best way to avoid histamine poisoning is by preventing its production. This can be accomplished by: (i). Increasing care in handling, washing and icing fish products. (ii) Appropriate refrigeration from the time of capture to the cooking time and refrigerating should be at or below 4^o C (40^o F) at all times. (iii). Rejection of fresh fish kept at >4^o C at delivery (iv) Review of delivery vehicle temperature logs (industry). Fish with a bad odor or a “honey-combed” appearance should not be consumed. (v) Fresh fish should be used within 48 hours at refrigerated temperatures (*BC Centre 2008*).

Studies have shown that histamine-intolerant individuals may have a deficiency of the enzyme diamine oxidase in the small intestinal mucosa, resulting in decreased breakdown, and increased absorption of histamine in the gastrointestinal tract (Auckland clinic 2008).

A number of drugs have also been shown to inhibit diamine oxidase; they include: Clavulanic acid (in Augmentin[®]), Metochlorpropamide, Promethazine, Monoamine oxidase inhibitors, Isoniazid, Doxycycline, Verapamil, Micro nutrients (zinc, manganese, niacin, vit B₁₂ and folate. These may increase histamine levels. Alcohol is a potent histamine inducer to sensitive individuals (Auckland clinic 2008).

The limit for histamine content is set at 10 mg per 100 g of flesh fish of the *Scombridae* and *Clupeidae* families at the point of first sale in European Union (EU) (Judite and Jana 2004). The FDA has set a limit of not above 50 ppm of histamine in fish (FDA 1996), and it's the alert level considered hazardous to induce a toxic response in humans (Karen et al, 2004)

Various tests for allergies are available (skin prick test and specific IgE blood test, RAST-type) and are specific to allergens, but a person with histamine poisoning will normally have negative allergy tests, despite having symptoms that mimic the allergic reactions (Auckland clinic 2008). Several studies have been carried out to assess the histamine content in fish products in Asia and other parts of the world, but few reports are from Africa. One study that was done in Taiwan, showed that histamine content in most of the fish products exceeded the 50 ppm USFDA guideline value, and 7.4% (2/27) of the tested samples contained >1000ppm of histamine. Consumption of such products could lead to scombroid poisoning (Hsiang Tsai et al, 2005). In a study conducted in Peru assessing the histamine level in fish sold in Lima markets (retail and wholesale) at different hours of a day, it was found that 75% of fish bought eight hours after catch had histamine levels > 10ppm. These results highlight the need to reinforce seafood safety regulations and quality control in developing countries including Tanzania and Peru (Gonzaga VE et al, 2009).

Incidents and/or outbreaks of histamine poisonings have been reported in various places whenever raw spoiled fish were eaten. In Switzerland for example, in 25 years (1966-1991) a total of 76 incidents after intake of tuna fish were reported to Swiss Toxicological Information Centre (Maire R et al, 1992). From 1976 to 1986, 258 incidents of suspected scombroid fish poisoning were reported in Britain. Histamine

analysis was carried out on 240 fish samples from these incidents, and 101 were found to contain greater than 50 ppm histamine (*Bartholomew et al, 1987*). From 1994 to 1997 North Carolina (USA) reported an average of 2 cases annually; however, from July 1998 to February 1999, a total of 22 cases of histamine fish poisoning were reported (*Becker K et al, 2001*). Between 1992 and 1999, 10% of the infectious intestinal disease outbreaks reported to the Communicable Disease Surveillance Centre (USA) were associated with fish, about half of those to HFP (*Attaran and Probst, 2001*). Outbreaks of HFP to TB patients (378) taking isoniazid (INH) were reported after ingesting fish. Eight patients presented with the allergy-like symptoms such as flushing, headache, palpitation, itching, wheezing, dyspnea and diarrhea within 20 minutes to two hours (*Miki M et al, 2005*).

Although there is compelling evidence to implicate histamine as the causative agent in HFP, there is no straightforward dose–response relationship, as spoiled fish containing histamine tends to be more toxic than the equivalent amount of pure histamine dosed orally (*Ijomah et al.,1992; Lehane and Olley 2000*). When 180 mg histamine base (given as 500 mg histamine phosphate) was administered orally, there was no noticeable effect in humans, but 7 µg administered intravenously caused vasodilatation and increased heart rate (*Weiss et al., 1932*). In another study about 67.5 mg histamine was administered to humans orally without any toxic effects (*Granerus G., 1968*); but when 100–180 mg histamine mixed in grapefruit juice was administered orally or in 100 g of high-quality tuna, characteristic symptoms of mild histamine poisoning (mild-to-severe headache and obvious flushing) were observed in some people; (1/4 and 4/8, respectively) (*Motil and Scrimshaw 1979*).

Administration of 50 g of fresh mackerel to volunteers to which 300 mg histamine had been added (a dose of about 5 mg/kg bodyweight), resulted into only mild symptoms of histamine poisoning (oral tingling, headache and flushing in some subjects). However, 50g of spoiled mackerel with 300mg of added histamine was no stronger in its effect (*Clifford et al, 1989*).

A survey of scombroid fish poisoning in Britain suggested that most cases were uncomplicated histamine poisoning, but that other toxins may have been involved when suspected fish contained little histamine, or when symptoms were not typical. The authors reported 258 incidents of suspected scombroid fish poisoning (*Bartholomew et al, 1987*). Of 240 fish samples from these incidents, 101 contained

>5 mg histamine/100 g fish. The symptoms most consistently reported were rash, diarrhoea, flushing and headache. In any incident, the symptoms of all patients were similar, although each patient did not experience all symptoms. Of fish with >20 mg histamine/100 g, 94% were from incidents in which scombroid-toxic symptoms were characteristic. When fish contained only 5–20 mg histamine/100 g fish, only 38% of incidents were “clinically distinctive”, with rash, flushing and burning of the mouth (*Bartholomew et al, 1987*). Although gastrointestinal symptoms especially diarrhoea were frequently experienced, in contrast with some previous reports (*Anorld and Brown, 1978*) gastrointestinal symptoms alone were not regarded as indicative of scombroid fish poisoning. Surprisingly, 36/93 fish samples (39%) with <5 mg/100 g histamine also gave rise to characteristic scombroid-toxic (or HFP) symptoms. Analyses were not done for other biogenic amines, which may have been histamine potentiators or toxic in their own right, or urocanic acid (*Lehane and Olley 2000*).

A number of scientists have postulated that histamine is potentiated by some other component or components in toxic fish (*Bjeldanes; Taylor; Chu; Lyons; Taylor and Stratton*). Such potentiators would act to decrease the threshold dose of histamine needed to provoke an adverse reaction in humans challenged orally. Certain drugs have definitely been implicated as contributing factors in cases of histamine poisoning (*Chin et al, 1989; Stratton and Taylor 1991*). *Taylor 1986* stated that doses of pure histamine required to produce mild reactions were “several times higher than the doses producing more severe symptoms when consumed with spoiled fish”. However, in the same publication he stated that “the variability in histamine levels in spoiled fish makes estimates of the toxic threshold difficult to obtain” and quoted an estimated threshold dose of histamine in fish at about 60 mg/100 g of flesh fish. Even after allowing for variability in human susceptibility and variable histamine content in different parts of fish, it seems that there is a difference between the relative lack of toxicity of pure histamine and the (often) apparent toxicity of histamine in spoiled fish (*Lerke et al, 1978*).

In support of the histamine-potentiator hypothesis, several in vivo and in vitro studies have suggested that the absorption, metabolism, and/or potency of one biogenic amine might be modified in the presence of a second amine (*Bjeldanes et al, 1978; Taylor et al, 1984*). The biogenic amines putrescine and cadaverine occur in appreciable quantities in toxic fish (*Arnols and Brown, 1978*) and at low levels in

non-toxic fish (*Mietz and Karmas, 1977*). When given in higher ratios relative to histamine than those that usually occur in toxic fish, these amines potentiate the biological activity of histamine in laboratory animals.

Uptake of unmetabolised histamine alone would not be sufficient to elicit some of the symptoms observed in HFP. To exert its full toxic effects, histamine must reach the peripheral tissues. The detoxification of histamine in extra-intestinal tissues must also be inhibited to achieve the full effects. Particularly if hepatic first-pass clearance of histamine is normally substantial, potentiators must act beyond the intestinal lumen to have an effect in increasing the toxicity of histamine taken orally (*Taylor et al, 1984*).

In Tanzania very little is known about histamine fish poisoning and other biogenic amines content in fish. The Tanzania food and drug authority (TFDA), which is responsible for safety and quality of food products has not set up a guideline regarding proper fish handling and storage, and the histamine limit content in fish imported or caught within the country. Most Clinicians are unfamiliar with histamine fish poisoning, and often misdiagnose with the fish allergy (*Attaran and Probst, 2002*). Knowledge of HFP among healthcare personnel and the public is crucial for prevention of HFP development. Poor or lack of knowledge of fish handling by fishermen and consumers after catch and during processes, results into fish spoilage that can lead into HFP when eaten by susceptible people.

1.1 PROBLEM STATEMENT

Suspected histamine fish poisoning is common in Dar es Salaam and is an important cause of morbidity. Clinical records from Muhimbili National Hospital (Mwaisela Block) showed that from March 2008 to March 2011, about 0.8% patients were admitted with swelling of the tongue, tachycardia, pruritus, and rashes following fish consumption; and laboratory investigation showed that both were negative to allergy test (skin prick test). On the same period, about 2.6% patients who attended New Outpatient Clinic at MNH had complaints of significant skin itching, eczema and body swelling following fish consumption.

Also, from January 2010 to February 2011, about 8.3% outpatients who attended at Amana referral hospital had complain of rashes, skin itching and abdominal cramps following fish consumption. These clinical records showed low prevalence of HFP and could be due to lack of awareness and knowledge among the people.

Proper storage conditions, fish handling after catch and processing are vital in preventing HFP. At Kigamboni ferry market in Dar es Salaam, most fishermen store their fish in boxes without icing and are prone to deterioration within short period of time. Because of that, most people unknowingly eat spoiled fish and hence may be susceptible to histamine fish poisoning.

1.2 RATIONALE

Knowledge of histamine fish poisoning among healthcare personnel is vital in management of seafood poisoning. Study showed that symptoms of fish associated allergic reactions mimic those of histamine fish poisoning, but the latter are always negative to allergic reaction tests. Misdiagnosis of HFP with fish allergy is therefore common (*Attaran and Probst, 2002*). Currently, most healthcare workers advice people suspected with fish allergy to avoid eating the same fish for fear of encountering another allergic reaction. This is the prevalent belief and majority of people may be deprived of fish as essential nutrient by fear of fish allergy whereas majority of fish poisoning may be HFP, which is not recurrent when the fish does not contain a lot of histamine. Therefore, assessing knowledge of HFP among healthcare personnel will allow appropriate intervention be taken by relevant authority to alleviate the problem of misdiagnosis with fish allergy in future; and appropriate advice be given by healthcare personnel to patients. Knowledge on distinguishing features between fish allergy and HFP will enlighten healthcare personnel and solve this ambiguity.

Results of this study will also emphasize the need of improving fish handling after catch by fishermen and raise awareness to consumers to avoid spoiled fish that have been caught for several hours and left without refrigeration. Fish stored at temperature above 16⁰C and on contact air will spoil and are likely to have high content of histamine that may lead to HFP (*Clark et al, 1990*).

There is a tendency of underreporting of the HFP incidence by people considering it in most cases to be mild, self limiting and resolves within minutes. Hence this study will raise awareness in the community members that in some cases the incident may be life threatening accompanied with anaphylactic shock that may lead to death and hence need to be reported.

1.3 OBJECTIVES

1.3.1 Broad Objective

To assess awareness and knowledge of health care personnel and fish consumers on histamine fish poisoning in Dar es Salaam region

1.3.2 Specific Objectives

- (i) Determination of awareness of histamine fish poisoning (HFP) among health care personnel and fish consumers in Dar es Salaam region.
- (ii) Assess knowledge of histamine fish poisoning among fish consumers in Dar es Salaam region
- (iii) Assess knowledge of histamine fish poisoning (HFP) among health care personnel in public and private hospitals in Dar es Salaam region.
- (iv) List the type of fish (species) that are associated with allergic reactions/HFP
- (v) Investigational knowledge on the difference between histamine fish poisoning and fish-associated allergic reactions among health personnel

CHAPTER TWO

2 METHODOLOGY

2.1 Study Design

A prospective descriptive cross sectional study was conducted to assess level of awareness and knowledge of histamine fish poisoning among fish consumers and health care personnel in Dar es Salaam region. Structured questionnaires were employed in data collection and were administered to consented participants.

2.2 Study Area and Population

The study was conducted in Dar es Salaam region which has a population of 2,698,652 by January 2009 according to the Genomes geographical data base, with the population projection of 3,216, 447 in 2012 by the Population Planning Unit.

Health care personnel were from Muhimbili National Hospital, The Agha khan hospital, Temeke, Amana and Mwananyamala hospitals as well as Sinza and Buguruni Health centres. Health care personnel comprised of, clinical officers, assistant medical officers, medical officers, intern doctors, residents and physicians.

Fish consumers were residents from Ilala, Temeke and Kinondoni Municipals in Dar es Salaam.

2.3 Sampling methodology

Convenient sampling technique was used to select participants whereby data collectors conducted face to face interview with participants in selected study areas in Dar es Salaam region. In areas they visited (e.g Kigamboni ferry market), data collectors moved around the market and interviewed any fishermen and customers who were willingly ready to participate in the study, after being given detailed information on the objective of the study.

2.4 Sample Size

The sample size of the study was calculated based on estimating awareness of histamine fish poisoning among residents in Dar es Salaam. Anticipating awareness of 50% for both fish consumers and health care personnel, with an absolute precision of $\pm 5\%$ and confidence level of 95%, the minimum number of participants that was involved in this study was about 385, and was obtained by using the following statistical formula:

$$N = \frac{(Z/W)^2}{p(1-p)}$$

Where N = required sample size

W= margin of error (standard value of 0.05)

P = estimated prevalence (0.5)

Z = confidence interval level at 95% (standard value of 1.96)

$N = (1.96/0.05)^2 \times 0.5 \times 0.5 = 384.16 \approx 385$ participants.

2.5 Exclusion and Inclusion criteria

2.5.1 Inclusion criteria

- (i) Participants who are above 15 years of age
- (ii) Those who haven't been diagnosed with any disease for the past 72 hours
- (iii) Those not under medications
- (iv) Health care personnel directly involved in patient care at participating facilities.

2.5.2 Exclusion criteria

- (i) Participants who are unconscious, unable to feed by themselves
- (ii) Those that are below 15 years of age
- (iii) Participants diagnosed with any disease for the past 12 hours.
- (iv) Participants who are on medication (long term as well as short term)
- (v) Participants who have never taken fish
- (vi) Health care personnel like pharmaceutical personnel, nurse officers, nurse midwifery and ward attendants who are not directly involved in patient diagnosis.

2.6 Data Collection methods

Data were collected using structured questionnaires for health care personnel and fish consumers. The questionnaires were constructed in English and translated into Swahili, and were pretested prior to administration to participants with the help of trained research assistants.

Four trained data collectors who were second year bachelor of pharmacy students at MUHAS were involved in data collection; two data collectors visited the health

facilities to interview health care personnel while two data collectors visited various parts of the city of Dar es salaam to interview the residents who are fish consumers. In Ilala municipal they visited the Kigamboni ferry market and Buguruni malapa market and 80 participants were conveniently sampled; In Kinondoni municipal, 115 participants were conveniently sampled from Tangibovu, Manzese and Mbezi Luis areas; and in Temeke they visited Temeke market and Wailes area where 85 participants were sampled.

From Muhimbili National hospital, 5 physicians were sampled as well as 10 Residents, and 13 intern doctors from Mwisela block wards, doing internal medicine rotation. Other healthcare personnel from other health facilities were also conveniently sampled.

Data collectors conducted face to face interview and participants were provided with detailed information of the study and the questions to be addressed. They were then asked for their consent to participate in the study.

Several validation and data checking steps were employed during and after data collection to ensure data quality. In total 280 fish consumers and 105 health care personnel were interviewed in this study.

The study sought to measure certain demographic characteristics of the participants, their level of awareness and specific knowledge regarding histamine fish poisoning.

Awareness of histamine fish poisoning to fish consumers was assessed by the correct response (that were consistent with HFP) from four (4) questions that were posed to consumers who had experienced problem(s) following fish consumption. The questions were based on ability to recall the clinical features/symptoms of the problem; duration of the symptoms presentation and elapse; any idea of the causes of the problem and whether they are still eating the same fish. For the health personnel, the awareness of histamine fish poisoning was assessed by the correct definition of HFP and description of any of its clinical features. Based on literature review, a set of ten statements representing the commonest signs and symptoms of HFP and fish icing significance were designed for fish consumers' knowledge assessments, while for health personnel knowledge was assessed by description of symptoms and signs, duration of symptoms onset and elapse, causes of HFP and management of HFP. Fish consumers were asked to give their response to these 10 pre-set questions by

writing “Yes”, or “No” to each statement. Each correct response scores one and incorrect response scored zero. For health personnel total score was 12 whereby, high score for correct description of the symptoms and signs at least 3, was four; duration of symptoms presentation and elapse score two; causes of HFP score two and management of HFP score four.

Knowledge of HFP among health care personnel and fish consumers was assessed by score marks. Those who score questions > 70% were considered to have good knowledge, 40%-69% average knowledge and < 40% low knowledge.

2.7 Pre-testing of the questionnaire

The questionnaires were pre-tested for content validity and readability prior to data collection by 10 participants who met the study criteria.

2.8 Data analysis plan

Questionnaire were checked and edited for any inconsistency or discrepancies. Data collected was coded, entered, cleaned and analyzed using the “Statistical Package for Social Sciences” (SPSS) software version 17 (SPSS Inc., Chicago, IL, USA). Results were summarized using descriptive statistics such as frequency distribution, mean, and whenever necessary and a test for chi square was done and the significance level was set at ($p \leq 0.05$)

2.9 Ethical consideration

Ethical approval for this research was obtained from the research and publication committee of Muhimbili University of Health and Allied Sciences. Permission to interview the health care personnel was obtained from medical directors or officer in-charges of the respective health facilities.

Participants were interviewed only after getting their written informed consent. They were informed on the objectives of the study, confidentiality of the information they provide and that their participation was voluntary.

CHAPTER THREE

3 RESULTS

This section reports the results obtained from the interviewed fish consumers and health care personnel from Dar es Salaam region. Results are categorized according to objectives.

3.1 Socio-demographic characteristics of the study population

A total of 385 participants were interviewed from Ilala, Kinondoni and Temeke municipals, of which 105 were health care personnel and 280 fish consumers.

Fish Consumers interviewed from Ilala municipal were conveniently sampled from Kigamboni ferry and Buguruni malapa markets; Kinondoni municipal, participants were from Manzese, Tangibovu and Mbezi Luis; Temeke municipals, participants were from Wailes and Temeke markets. Fish consumers were in age group of 15-65 years and they were divided into three groups with the age ranging from 15-25 years (37.5%), 26-40 years (47.1%) and 41-65 years (15.4%). Out of 280 fish consumers, 184 (65.7%) were male and 96 (34.3%) were female.

Health personnel interviewed were from Muhimbili national hospital, the Aga Khan hospital, Temeke, Amana and Mwananyamala regional hospitals, Sinza and Buguruni health centres. Out of 105 health care personnel male were 76 (72.4%) and female 29 (27.6%). Clinical officers were 29 (27.6%), intern doctors 21 (20.0%), medical officers 11 (10.5%), assistant medical officers 23 (21.9%), residents 13 (12.4%) and physician 8 (7.6%).

The table below summarizes the social demographic characteristics of the study population interviewed.

Table 1: Socio-demographic characteristics of fish consumers

FISH CONSUMERS (N=280)							
	Ilala Municipal		Kinondoni Municipal			Temeke Municipal	
	Kigamboni Ferry. n(%)	Buguruni Malapa. n(%)	Manzese n(%)	Tangibovu n(%)	Mbezi Luis. n(%)	Wailes. n(%)	Temeke Market. n(%)
Male	32(72.7)	16(55.2)	17(58.6)	19(65.5)	27(67.5)	34(68)	39(66.1)
Female	12(27.3)	13(44.8)	12(41.4)	10(34.5)	13(32.5)	16(32)	20(33.9)
Total	44(100)	29(100)	29(100)	29(100)	40(100)	50(100)	59(100)

Table 2: Health care personnel included in he study

HEALTH PERSONNEL (N=105)								
	Mnh n(%)	Aga n(%)	Tmk n(%)	Aman n(%)	M'nyl n(%)	Sinza H/C n(%)	Bugn H/C n(%)	Total n(%)
Physician	5(62.5)	3(37.5)	0	0	0	0	0	8(100)
Residents	10(76.9)	3(23.1)	0	0	0	0	0	13(100)
M. Officer	3(27.3)	2(18.2)	2(18.2)	1(9.1)	1(9.1)	2(18.2)	0	11(100)
A.M.O	0	0	6(26.1)	5(21.7)	5(21.7)	4(17.4)	3(13.0)	23(100)
Interns	10(47.9)	3(14.3)	2(9.5)	2(9.5)	4(19.0)	0	0	21(100)
C.Officer	0	0	8(27.6)	8(27.6)	5(17.2)	3(10.3)	5(17.2)	29(100)

3.2 Awareness of histamine fish poisoning among fish consumers and health care personnel in Dar es Salaam region

3.2.1 Fish Consumers

Generally, majority of fish consumers were not aware of HFP, and awareness was found to be 37 (26.6%), 20 (54.1%) male being more aware than female 17 (45.9%). Also, participants with age group 26-40 years had higher awareness, 16 (43.2%) than the other age groups, 13 (35.1%) for age group of 15-25 years and 8 (21.6%) for age group of 41-65 years. From the three municipals, awareness was higher in Kinondoni, 18 (48.6%), followed by Ilala, 13 (35.1%) and Temeke 6 (16.2%). However awareness was insignificantly associated with sex ($P = 0.153$), age group ($P = 0.156$) and residence ($P = 0.291$). (Table 3)

Awareness of histamine fish poisoning among fish consumers was assessed based on the response from four questions posed to consumers who had experienced problems following fish consumption; ability to recall the clinical features; duration of the symptoms presentation and elapse; causes and whether they are still eating the same fish.

Out of 280 fish consumers that were interviewed, 139 (49.6%) reported to have experienced problem after eating fish, and out of 139, only 37 (26.6%) responded correctly the four questions for awareness assessment of HFP. Five mostly recalled

clinical features by consumers were skin itching 20 (54.1%), rashes 17 (45.9%), diarrhea 22 (59%), abdominal cramps 19 (51.4%) and swelling of different parts of the body such as around the mouth, and lips 13 (35.1%). Duration of the symptoms presentation were between 15 minutes to 48 hours and symptoms elapse were between 6 hours to 72 hours; they responded on the causes of HFP being due to eating spoiled fish. They also responded that they continue eating the same fish with no problems.

The remaining 102 (73.4%) failed to respond correctly the four questions; about 47 (33.8%) recalled the symptoms but their response on duration of symptoms presentation and elapse; causes of HFP were not consistent with HFP.

3.2.2 Health Personnel

Awareness of HFP among health care personnel was high, and found to be 63 (60%) out of 105 health care personnel interviewed, 43 (68.3%) male and 20 (31.7%) female (Table 4). Among those had awareness, 12 (92.3%) of residents, 9 (81.8%) of medical officers, 17 (73.9%) of assistants medical officers, 12 (57%) of intern doctors, 5 (17.2%) of clinical officers and all physicians 8 (100%) had awareness of HFP. Awareness was found to be significantly associated with medical cadres interviewed ($P < 0.05$).

Awareness of HFP among health care personnel who have attended patients with HFP was assessed based on the response from three questions; correct definition of HFP, ability to list at least two clinical features/symptoms of HFP and its distinguishing features from fish allergy.

About 63 (60%) of the health care personnel responded to have attended patients with HFP, and they were subjected to the questions for awareness assessments. All 63 (60%) responded correctly to three questions for awareness assessment, which were consistent with HFP. Skin itching 52 (82.5%), rashes 54 (85.7%), diarrhea 60 (95.2%), pruritus 61 (96.8%), body swellings 55 (87.3%) and abdominal cramps 35 (55.6%) were the main clinical features listed by health personnel for HFP. They also responded that HFP was food poisoning that happens after eating spoiled fish with high content of histamine. On the distinguishing features between HFP and fish allergy, they responded that patients with HFP usually symptoms resolves within 24 to 48 hours, rarely involving days or weeks, since it does not involve immune

reactions; but fish allergy involve immune reactions and symptoms may resolves for days or weeks. When asked for the allergy test, 23 (36.5%) responded to have requested allergy tests, and for HFP they responded being negative most of the time to allergy test (skin prick test). But for those with fish allergy are often positive to skin prick test or blood allergy tests.

Table 3: Awareness of HFP among fish consumers

Participants interviewed (N=139)				
Characteristics (n)	Awareness		P - value	
	YES n(%)*	NO n(%)*		
Male (72)	20 (27.8)	52 (72.2)	0.153	
Female (67)	17 (25.4)	50 (74.6)		
Age group:	15-25 (50)	13 (26)	37 (74)	0.156
	26-40 (78)	16 (20.5)	62 (79.5)	
	41-65 (11)	8 (72.7)	3 (27.3)	
Residence:	Ilala (49)	13 (26.5)	36 (73.5)	0.291
	Kinondoni (63)	18 (28.6)	45 (71.4)	
	Temeke (27)	6 (22.2)	21 (77.8)	

***Percentage calculated based on the total number of those with awareness in each row*

Table 4: Awareness of HFP among health care personnel

Participants interviewed (N = 105)			
Characteristics (n)	Awareness		P - value
	YES n(%)*	NO n(%)*	
Male (76)	43 (55.6)	33 (43.4)	0.247
Female (29)	20 (69.0)	9 (31.0)	
Physician (8)	8 (100)	0	0.0001
Residents (13)	12 (92.3)	1 (7.7)	0.0003
Medical officer (11)	9 (81.8)	2 (18.2)	0.0025
Assistant medical officer (23)	17 (73.9)	6 (26.1)	0.003
Intern doctor (21)	12 (57.1)	9 (42.9)	0.0012
Clinical officer (29)	5 (17.2)	24 (82.8)	0.0062

**Percentage calculated based on the total number of those with awareness in each row*

Table 5: Awareness of HFP among health personnel and their Health facility

Awareness among health personnel (N=63)								Total
Awareness n(%)	Mnh n(%)	Aghk n(%)	Tmk n(%)	Aman n(%)	M'nya n(%)	Sinza H/C. n(%)	Bugn H/C. n(%)	
Physician	5 (62.5)	3 (37.5)	0	0	0	0	0	8 (100)
Residents	10 (83.3)	2 (16.7)	0	0	0	0	0	12(100)
M. Officers	3 (33.3)	2 (22.2)	2 (22.2)	1 (11.1)	1 (11.1)	0	0	9(100)
AMO	0	0	4 (26.7)	4 (26.7)	4 (26.7)	2 (13.3)	1 (6.7)	15(100)
Interns	8 (66.7)	2 (16.7)	1 (8.3)	0	1 (8.3)	0	0	12(100)
C. Officer			2 (40)	1 (20)	2 (40)	0	0	5(100)

3.3 List of fish types associated with histamine fish poisoning

Among the fish consumers that had experienced problem after fish consumption, (N =139), only 68 (48.9%) were able to list the suspected type of fish associated with histamine fish poisoning. For the non scombroid fish and other sea foods, Octopus was listed most (41) followed by Claria or Cat fish (31), Nile perch (20) and Tilapia (19). The frequency of Mackerel was 23 for the scombroid fish followed by Tuna (8) and King fish (7) (Table 6).

For the health personnel, out of 63 whom had awareness of the histamine fish poisoning only 40 (63.5%) were able to list the fish types associated with histamine fish poisoning. The frequency of non scombroid fish and other sea foods was 20 for octopus, Claria 14 and Tilapia 10. For the scombroid fish mackerel was listed most (19) followed by King fish (14) and Tuna (13) (Table 7).

Table 6: Fish types associated with histamine fish poisoning (fish consumers)

(i) Non Scombroid fish (N=139)		
Fish type	Frequency	Percentage ^{**}
Octopus (pweza)	41	29.5
Cat fish or Claria (Kambale)	31	22.3
Nile perch (sangara)	20	14.4
Tilapia (Perege)	19	13.7
Squids (Ngisi)	16	11.5
Red snapper (Sato)	13	9.4
Scavenger (Changu)	10	7.2
Shark (Papa)	7	4.3
Half beak (chuchungi)	5	3.6
Sardines (dagaa)	14	10.1
Lobsters (kambakochi) – <i>sea foods</i>	8	5.8
Small shrimps (uduvi) - <i>Sea foods</i>	2	1.4
(ii) Scombroid fish		
Fish type	Frequency	Percentage ^{**}
King fish (nguru)	7	5
Mackerel (kibua)	23	16.5
Tuna (Jodari)	8	5.8

Table 7: Fish types associated with histamine fish poisoning (Health personnel)

(i) Non Scombroid fish (N=63)		
Fish type	Frequency	Percentage ^{**}
Cat fish or Claria (Kambale)	14	22.2
Nile perch (sangara)	4	6.3
Tilapia (Perege)	10	15.9
Squids (Ngisi)	7	11.1
Star fish	2	3.2
Scavenger (Changu)	5	7.9
Shark (Papa)	2	3.2
Clay fish	3	4.8
Octopus (pweza)	20	31.7
Lobsters (kambakochi) – <i>sea foods</i>	2	3.2
Small shrimps (uduvi) – <i>Sea foods</i>	2	3.2
(ii) Scombroid fish (N=63)		
Fish type	Frequency	Percentage ^{**}
King fish (nguru)	14	22.2
Mackerel (kibua)	19	30.2
Tuna (Jodari)	13	20.6

Percentage calculated based on the total number of those with awareness in each row (N=63)

3.4 Assessment of knowledge of Histamine fish poisoning among health care personnel and fish consumers

The study showed that the majority of fish consumers and the overall knowledge among health care personnel of HFP were low, although physicians and residents were the most knowledgeable among the health workers (Table 9). Knowledge level among health workers was significantly associated with clinical rank ($P < 0.05$) and insignificantly associated with sex ($P = 0.216$). For the fish consumers, knowledge level was insignificantly associated with sex ($P = 0.847$), residence ($P = 0.231$) and age group ($P = 0.847$).

Out of 105 health care personnel and 280 fish consumers that were interviewed, 60% and 49.6% of the health care personnel and fish consumers respectively responded to the pre-set questions assessing specific knowledge on HFP. Exploring the various dimensions of knowledge variables describing specific knowledge of HFP in this study, showed that health care personnel on a 12-point scale pertaining to (knowledge) causes, description of clinical features, duration of symptoms presentation and elapse and management of HFP, the respondents recorded a mean score of 5.91 (standard Error of Mean (SEM) 0.239), well below average score; and on a 10-point scale for fish consumers pertaining to signs and symptoms of HFP the respondents recorded a mean score of 2.24 (SEM 0.088).

For assessing purposes of knowledge level, a score of above 70% was considered good knowledge, 40%-69% average knowledge and a score below 40% was considered low knowledge.

The study showed that about 9 (14.3%) of the health care personnel had good knowledge, 36 (57.1%) had average knowledge and 18 (28.6%) had low knowledge of HFP (Table 8). Among those with low knowledge, medical officers were 5.6%, intern doctors 11.1%, assistant medical officers 55.6% and clinical officers 27.8%. Residents and Physicians were the only health personnel with good knowledge of HFP (41.7% and 50.0% respectively) and all 5 (100%) clinical officers whom had awareness of HFP, had low knowledge. The study also showed that Males had more knowledge about HFP than females (Table 9).

Among the health personnel with low and average knowledge 54 (85.7%); five common clinical features that were described include diarrhea 50 (92.6%), skin itching 46 (85.2), skin rashes 42 (77.8%), body swelling 36 (66.7%) and abdominal cramps 25 (46.3%). Also, among those with average knowledge, 1 (2.8%) assistant medical officers described an event of a patient who had low blood pressure and abdominal cramps after fish (tuna) consumption and died within 24 hours at Buguruni Health Centre. The study further showed that, only 17 (31.5%) among those with low and average knowledge stated the duration of symptoms presentation and elapse of HFP being between 10 minutes to 72 hours. Among those with good knowledge, 4 (50.0%) physicians and 5 (41.7%) residents responded well to the questions. They described the clinical features of HFP as mild (e.g skin itching,

rashes, diarrhea, nausea and vomiting) to life threatening conditions such as low blood pressure, anaphylaxis that may lead to shock and death to some people. About 12 (22.2%) health personnel with low and average knowledge listed cetirizine (antihistamine) and prednisolone (corticosteroids) for management of HFP, and among those with good knowledge, they stated that mild symptoms normally resolve themselves within 72 hours, and cetirizine, loratidine, chlorompheniramine (antihistamine) and prednisolone (corticosteroids) can be used for mild HFP, and adrenaline injection can be administered in life threatening condition such as anaphylaxis and low blood pressure.

Among the fish consumers respondents, 136 (97.8%) had low knowledge and 3 (2.2%) had average knowledge of HFP (Table 10). For the low knowledge category, Male were 88 (64.7%) and female 48 (35.3%). (Table 11)

The study also showed that 74 (53.2%) of the fish consumers responded the cause of fish histamine poisoning being due to the body being allergic to the fish, 33 (23.7%) being due to eating spoiled fish that have poison (high histamine) and 32 (23%) responded don't know. When asked for the significance of icing, 86.3% of fish consumers responded it's beneficial for prevention of fish spoilage and 13.7% responded had no benefit rather makes the fish tasteless.

When asked what advice do they give the patients once have histamine fish poisoning, 38 (60.3%) of the health care personnel advised the patient not to eat the same fish again, 14 (22.2%) advised not to eat any fish again and 11 (17.5%) did advise nothing.

Table 8: Overall knowledge level of HFP among health personnel

Health care personnel (N=63)		
Knowledge level	Frequency (n)	Percentage
Low knowledge	18	28.6
Average knowledge	36	57.1
Good knowledge	9	14.3
Total	63	100

Table 9: Knowledge level of HFP among Health personnel

Characteristics (n)	Knowledge level			P -value
	Good knowledge n(%)	Average knowledge n(%)	Low knowledge n(%)	
Male (39)	7 (17.9)	20 (51.2)	12 (30.8)	0.216
Female (24)	2 (8.3)	16 (66.7)	6(25)	
Clinical officers (5)	0	0	5 (100)	0.0021
A. M. O (17)	0	7 (41.2)	10 (58.8)	0.0032
Intern doctors (12)	0	10 (83.3)	2 (16.7)	0.0041
Medical officers (9)	0	8 (88.9)	1 (11.1)	0.0033
Residents (12)	5 (41.7)	7 (58.3)	0	0.0023
Physician (8)	4 (50)	4 (50)	0	0.0012

**Percentage calculated based on knowledge level in each row.*

Table 10: Overall Knowledge level of HFP among fish consumers

Knowledge level	Frequency	Percentage
Low knowledge	136	97.8
Average knowledge	3	2.2
Total	139	100

Table 11: Knowledge level of HFP among fish consumers

Characteristics (n)	Knowledge level		P - value
	Average knowledge n(%)	Low knowledge n(%)	
Male (89)	1 (1.1)	88 (98.9)	0.332
Female (50)	2 (4)	48 (96)	
Age group: 15-25 (56)	1 (1.8)	55 (98.2)	0.294
26-40 (55)	1 (1.8)	54 (98.2)	
41-65 (28)	1 (3.6)	27 (96.4)	

**Percentage calculated based on knowledge level*

3.5 Assessment of the knowledge on the difference between histamine fish poisoning and fish associated allergic reaction among health care personnel.

All health personnel with awareness (63) responded that, there's difference between HFP and fish allergy, as the HFP is due to histamine intoxication in fish while fish allergy is due to IgE mediated body reaction.

But 23 (36.5%) of the health personnel elaborated further that, the two can be distinguished by recall of the previous history of the fish consumed as well as by laboratory allergy tests. They responded that HFP, usually negative to allergy tests while fish allergy is positive. Also, by recall of the previous history, someone with HFP usually had consumed the same fish with no problem but for fish allergy, immune reactions occur whenever that fish is consumed. This correlates with the study by *Attaran and Probst, 2002*.

CHAPTER FOUR

DISCUSSION

This study was undertaken to assess knowledge of histamine fish poisoning among fish consumers and health personnel. The results obtained showed that awareness of HFP among the fish consumers that had experienced problem after fish consumption were 37 (26.6%). These were people who correctly responded to the four questions, for awareness assessment. The remaining 102 (73.4%) responded partially to some of the questions and failed to explained others. This could be due to the fact that, it's possible for someone to recall the symptoms but failed to respond to the cause, since most of the symptoms of HFP are mild and resolves within minutes and therefore someone may not bother to know the cause. But also, the low prevalence of awareness among fish consumers could be accounted with the fact that, those who had experienced problems probably had improved the fish handling during processes and storage by refrigeration and therefore no longer victims of HFP. This corresponds to the response of the statement of icing significance whereby 86.3% of fish consumers responded that icing is beneficial for prevention of fish spoilage and only 13.7% responded had no benefits rather renders the fish tasteless. This correlates with a report by *BC Center 2008* which indicated that the best way to avoid histamine poisoning is by preventing its production through increasing care during handling, washing, icing and appropriate refrigeration from the time of capture to the cooking time. Among the three municipals, Temeke had low awareness 6 (16.1%) followed by Ilala 13 (35.1%) and Kinondoni 18 (48.6%), but the awareness was insignificantly associated with residence ($P = 0.291$) (Table 3).

The study also showed that, among the symptoms of HFP that were mostly recalled by respondents were diarrhea (59%), skin itching (54.1%), rashes (45.9%), abdominal cramps (51.4%) and body swelling (35.1%). Similar results were observed by *Muller et al, 1992* who reported diarrhea as a prominent clinical sign in 77% of patients (second in frequency only to skin rash, which occurred in 82%) in ten incidents of HFP involving 22 patients in South Africa.

Out of 105 health personnel interviewed, awareness was found to be 63 (60%), based on the response of three questions for awareness assessments (that were consistent with HFP). Results showed that all physicians 8 (100%) interviewed had awareness,

followed by residents (92.3%), medical officers (81.8%), assistant medical officers (73.9%), intern doctors (57%) and clinical officers (17.2%).

Also, among the cadres, 50.0% of physicians and 38.5% of residents had good knowledge and all clinical officers had low knowledge (Table 9). This result meant that although difference in medical knowledge among the personnel and their expertise in medical field contributed to varied awareness among the personnel, but hospital settings where the personnel work also have knowledge contribution and expertise in medical field. This is because, presence of allergy tests to hospitals like Amana and Mwanayamala has contributed to awareness of HFP among clinical officers working in these hospitals, contrary to clinical officers working at Sinza and Buguruni health centers whereby allergy tests is not done, and hence both had no awareness (Table 5). Presence of two (2) assistant medical officers from Sinza and 1 from Buguruni health centre having awareness of HFP, implies that these personnel might have been working somewhere else where allergy test was being done, before being transferred to these health centre, because for assessment of awareness, personnel was supposed to respond to three questions, one being the distinguishing features between fish allergy and HFP, among other things, depends on allergy tests.

This study also indicated that the term scombroid fish poisoning which refers to histamine fish poisoning is improperly used because even non scombroid fish such as Cat fish, Octopus and Sardines (both salty water and fresh water fish) have been implicated in histamine fish poisoning. *Taylor et al, 1989* obtained similar results in their study whereby spoiled non scombroid fish (mahi mahi, blue fish and sardines) were implicated in HFP. It's therefore crucial for the community to improve fish handling after catch and during storage, and avoid eating or buying spoiled fish not necessarily scombroid fish, to prevent development of HFP. Results further showed that among the fish implicated with HFP, Octopus was listed frequently compared to other fish by both fish consumers and healthcare personnel. The non scombroid fish that were frequently listed include Cat fish or Claria, Nile perch, Tilapia, Squids and Sardines. Mackerel was frequently listed among the scombroid fish, followed by Tuna and King Fish (Table 6 & 7). This results correlates with several studies that have been conducted that implicated mackerel, tuna and king fish being responsible for histamine fish poisoning (*Wu et al, 1997; Chamberlain, 2001; Victoria 2005*).

Since Tuna, mackerel and king fish are commonly sold in many markets in Dar es Salaam, fish consumers are urged to take precautions by purchasing fresh fish that are properly stored by icing or refrigeration and avoid spoiled fish. Fishermen as well, immediately after catch should store their fish before sale by icing; similarly to fish vendors, when roaming in streets for customers, should improve fish storage by icing or refrigeration. This is because, *study by Wu et al, 1997; Taylor et al, 1989* showed that scombroid fish have high histidine in their muscle, and at temperature above 16⁰C, will decompose into histamine by histidine decarboxylase produced by *Proteus morgani* bacteria, and therefore the histamine initiate the poisoning.

In assessing knowledge among fish consumers, 10 pre-set questions based on literature review were formulated for assessing signs and symptoms of HFP. Results showed that, 97.8% of fish consumers had low knowledge while 2.2% had average knowledge. The large proportions of fish consumers with low knowledge could be due to the fact that, symptoms presentation among patients with HFP varies and it's not possible for all patients to present the same symptoms at the same time. The study also showed that, among fish consumers who had developed problem (139) after fish consumption, only 13 (9.4%) responded to have gone to the hospital to seek medical services. This is important because, although HFP symptoms resolves within 6-72 hours as the respondents and literature indicated; and the commonly symptoms mentioned being diarrhea, itching and rashes, sometimes life threatening conditions such as low blood pressure, anaphylaxis and palpitations or tachycardia may happen, as described by physicians and some residents in this study.

The results on the investigational knowledge on the difference between histamine fish poisoning and fish allergy among health personnel showed that, all personnel with awareness responded that, there is a difference, as the former is due to histamine in fish while the latter is due to immune body reactions. But only 23 (36.5%) elaborated further that HFP to allergy tests, presents negative in most cases while fish allergy presents positive. This correlates with the Case report by Auckland Allergy Clinic in New Zealand whereby skin prick tests plus specific IgE (Rast-type) blood tests conducted to all common seafood including tuna being negative. This follows a 46 year old businessman who developed flushing, "hives", nausea and diarrhea after eating seared tuna and king fish at a popular Ponsonby restaurant (*Auckland allergy clinic, 2008; www.allergyclinic.co.zn*)

However, one of the limitations of this study is the failure to determine histamine levels (histamine contents) in suspected fish types listed in this study by participants, due to failure to develop a method for histamine analysis in suspected fish within the study period, as well as consistent machine breakdown (HPLC). Determination of histamine levels in suspected fish types would have given scientific proof of how big the problem is in Tanzania particularly to fresh water fish like Tilapia which have been implicated in this study. But also it would have helped to solve the ambiguity of the symptoms recorded in this study by participants, either being of HFP or Fish allergy.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

This study had showed that awareness and knowledge of histamine fish poisoning among fish consumers is low, since only 26.6% and 97.8% of the respondents interviewed, had awareness and low knowledge level respectively. The study further showed that, not only scombroid fish like Tuna, Mackerel and King Fish, implicated in many studies for histamine fish poisoning, but also non scombroid, fresh and salty water fish like Tilapia, Cat fish, Nile perch and Red snapper, have been reported by respondents being responsible for histamine fish poisoning. It's therefore important for the fish consumers and the public in general to improve fresh fish handling after catch and during storage by icing and refrigeration; and should avoid purchasing spoiled fish that have been left for several hours in air after catch. But also, awareness of icing significance, refrigeration as well as proper storage conditions for fish should be disseminated to all fish vendors and fishermen for prevention of fish spoilage and hence development of HFP to susceptible people.

For the health care personnel, training should be designed to increase awareness among personnel particularly those health facilities that serve the public at periphery, including health centre, which does not have access to allergy tests. The ministry of health and development partners should supply allergy tests to most of the hospitals and health facilities especially those in periphery. Availability of these tests to hospitals and other facilities will polish the knowledge and understanding of low cadre clinicians like clinical officers. This study showed that clinical officers working at Mwanyamala and Temeke regional hospitals which do allergy tests, had awareness compared to those working at Sinza and Buguruni health centers

(Table 5.)

Although the mortality of HFP is usually rare, clinicians and other healthcare personnel should not neglect it as some of the respondents indicated. It may be accompanied with life threatening conditions particularly in individuals with pre existing cardiac and respiratory conditions such as coronary artery disease and bronchial asthma. In these patients serious complication such as cardiac and respiratory collapse can occur in case they eat fish with excess amount of histamine.

Other studies should be carried out to quantify histamine levels in fish reported by this study especially non scombroid flesh water fish such as Tilapia, Cat fish and Nile perch, which are most frequently eaten fish in Dar es Salaam.

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APPENDIX I: Questionnaire for health care personnel

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
SCHOOL OF PHARMACY

Topic: Assessment of knowledge of Histamine Fish
Poisoning among Health care personnel in Dar es Salam region

Dear Participant, thank you for taking your time and participate in filling this questionnaire. This questionnaire intends to seek information on knowledge of histamine fish poisoning among health care personnel in Dar es Salaam. The researcher is a post graduate student at MUHAS; and the information you give will be used for academic purposes, therefore will be confidential and there is no need to write your name in this form.

A: Participant information-Health care personnel (TICK where appropriate)

Sex:

M	
---	--

F	
---	--

Name of Health facility:

Profession:

- 1: Clinical Officer
- 2: Assistant Medical Officer
- 3: Intern doctor
- 4: Medical Officer
- 5: Resident
- 6: Physician

B: Histamine Fish Poisoning Awareness Questions (Tick the correct response where appropriate)

1. In your carrier have you attended any patient who complained suffering after fish consumption?

1.	YES		2.	NO	
----	-----	--	----	----	--

(a) If Yes No.1, What do you understand by histamine fish poisoning?

(b) List any clinical features of histamine fish poisoning.

(c) Is there a difference between fish allergy and HFP?

2. List any type of fish that you know, are mostly associated with the problem.

1:.....2:.....3:.....

3. If YES No.1 did you take or request any allergy test?

1.	YES		2.	NO	
----	-----	--	----	----	--

4. If the allergy test was POSITIVE or NEGATIVE what did you advice the patient?

Allergy test:

Positive	
Negative	

Advice to the patient:

1.	Don't eat the same fish again	
2.	Don't eat any fish again	
3.	NONE	

C: Specific knowledge questions (Tick where appropriate)

1. Describe any clinical features of histamine fish poisoning that you know.
2. What is the duration of symptoms of HFP presentation and elapse?
3. What are the causes of histamine fish poisoning?
4. List drugs that are used in management of histamine fish poisoning
5. Do you think there is a difference between fish-associated allergy and histamine fish poisoning?

1.	YES		2.	NO	
----	-----	--	----	----	--

6. If YES No.7, give reason(s)

.....
.....
.....
.....
.....

THE END

APPENDIX II: DODOSO LA KISWAHILI-WALAJI WA SAMAKI

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
SCHOOL OF PHARMACY

Topic: Assessment of knowledge of Histamine Fish
Poisoning among fish consumers in Dar es Salaam

Ndugu mshiriki, Napenda kukushukuru kwa kutoa muda wako na kukubali kujaza formu hii. Lengo la kujaza fomu hii ni kupata taarifa juu ya uelewa wa madhara yanayoweza kutokea kwa baadhi ya watumiaji wa samaki. Taarifa hizi zitatumika kitaaluma zaidi hivyo nakuthibitishia kuwa taarifa zote utakazotoa ni SIRI na hutakiwi kuandika jina lako.

A: Taarifa za Mshiriki

Jinsia:

1.	Mmke		2.	Mme	
----	------	--	----	-----	--

Wilaya:..... Makazi:.....

Umri:

B: Maswali kupima uelewa wa madhara yatokanayo na samaki walio na
“histamine”(Weka alama ya Tick kwenye jibu sahihi)

1. Ulishawahi kula samaki katika maisha yako?

1.	Ndiyo		2.	Hapana	
----	-------	--	----	--------	--

2. Uliwahi kupata madhara/tatizo lolote baada ya kula samaki

1.	Ndiyo		2.	Hapana	
----	-------	--	----	--------	--

(a) Kama NDIYO, unaweza kutaja madhara yaliyokupata? Je, hapo awali ulikuwa unakula samaki huyo huo bila madhara kukupata?

NDIYO/HAPANAhuohuyo

(b) Kama NDIYO, unakumbuka ilichukua muda gani dalili hizo kujitokeza?

(c) Nini ulifanya baada ya madhara hayo?

1.	Nilikwenda hospitali kwa matibabu		2.	Nilikunywa dawa	
3.	Sikufanya chochote				

3. (a) Je, baada ya madhara kwisha, bado unakula (aina ile ile ya) samaki?

1.	Ndiyo		2.	Hapana	
----	-------	--	----	--------	--

(b) Kwa nini?

1.	Naogopa nikila tapata madhara tena	
2.	Sipati madhara hata nikila tena	
3.	Daktari amenishauri nisile tena	

4. Unadhani madhara yaliyokupata yametokana na nini?

1.	Sumu iliyomo ndani ya samaki		2.	Kula samaki aliyeoza	
3.	Mwili kuwa na “allergy” na samaki		4.	Sijui	

5. Taja aina ya samaki waliokuletea madhara, kama ulivyoeleza hapo awali.

(i).....(ii).....(iii).....

(iv).....(v).....

6. (a) Unadhani kuna umuhimu wa kuweka barafu kwenye samaki baada ya kuvua na wakati wa mauzo? NDIYO/HAPANA.

(b) Toa sababu

C: Maswali maalumu yanayoangalia uelewa wa madhara ya kemikali ya “histamine” kwenye samaki.

Zifuatazo ni baadhi ya dalili zitokanazo na madhara ya sumu ya “histamine” kwenye samaki:

1	Kichefuchefu na kutapika	Ndiyo		Hapana	
2	kuharisha	Ndiyo		Hapana	
3	Ngozi kuwasha	Ndiyo		Hapana	
4	Rashes and pruritis	Ndiyo		Hapana	
5	Sehemu mbalimbali za mwili kuvimba	Ndiyo		Hapana	
6	Tumbo kuuma kwa kuvuruga	Ndiyo		Hapana	
7	Kushindwa kupumua vizuri	Ndiyo		Hapana	
8	Kujisikia kizunguzungu au kichwa kizito	Ndiyo		Hapana	
9	Madhara ya histamine mara nyingi hutokana na kula samaki waliharibika (waliooza)	Ndiyo		Hapana	
10	Uwekaji wa barafu kwenye samaki baada ya kuvua na wakati wa mauzo ni muhimu .	Ndiyo		Hapana	

MWISHO

APPENDIX III: Questionnaire for fish consumers (English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL OF PHARMACY

Topic: Assessment of knowledge of Histamine Fish
Poisoning among fish consumers in Dar es Salaam

Dear participant, thank you for taking your time and participate in filling this questionnaire. This questionnaire intends to seek information on knowledge of histamine fish poisoning among fish consumers in Dar es Salaam. The researcher is a post graduate student at MUHAS; and the information you give will be used for academic purposes, therefore will be confidential and there is no need to write your name in this form.

A: Participants information-Fish consumers (TICK where appropriate)

SEX:

1.	Male	<input type="checkbox"/>	2.	Female	<input type="checkbox"/>
----	------	--------------------------	----	--------	--------------------------

District:..... Study area:.....

Age:

B: Histamine Fish Poisoning Awareness Questions (TICK where appropriate)

1. In your life time, have you eaten fish?

1.	YES	<input type="checkbox"/>	2.	NO	<input type="checkbox"/>
----	-----	--------------------------	----	----	--------------------------

2. Had you experienced any problem after eating fish?

1.	YES		2.	NO	
----	-----	--	----	----	--

(a) If Yes, would you recall the clinical features of the problem you faced?

(b) If Yes, how long did it take to present the symptoms?

(c) What did you do after symptoms presentation?

1.	I went to the hospital		2.	I self medicate	
3.	I did nothing				

3. (a) After symptoms resolve, are you still eating the same fish?

1.	YES		2.	NO	
----	-----	--	----	----	--

(b) Why?

1.	I'm afraid not to encounter another problem	
2.	Nothing happens even when I eat	
3.	I have been advised by the doctor not to eat again	

4. From your understanding, what is the cause of the problem you encountered after fish consumption?

1.	The fish had "poison"		2.	The fish was spoiled	
3.	I have allergy with that fish		4.	I don't know	

5. List the type of fish that was associated with the problem.

(i):.....(ii):.....(iii)

(iv).....(v).....

6. (a) Do you think there is any significance of fish icing or refrigeration after catch or during storage and sale? YES/NO:

(b) Explain Why.

C: Specific Knowledge Questions (Tick where appropriate)

The following are symptoms and signs most patient present with histamine fish poisoning and fish icing significance:

1	Nausea and Vomiting	YES		NO	
2	Diarrhea	YES		NO	
3	Skin itching	YES		NO	
4	Rashes and pruritis	YES		NO	
5	Body swelling	YES		NO	
6	Abdominal cramp or stomach ache	YES		NO	
7	Dyspnoea	YES		NO	
8	Dizziness or Giddiness	YES		NO	
9	HFP is associated with eating spoiled fish	YES		NO	
10	Fish icing is significant after catch or during subsequent handling and processing.	YES		NO	

END

APPENDIX IV: INFORMED CONSENT AGREEMENT (ENGLISH VERSION)

Assessment of knowledge of histamine fish poisoning among fish consumers and health care personnel in Dar es Salaam region, Tanzania

Sponsor; Ministry of health and social welfare

Principle investigator; Ngwegwe Bulula

From Muhimbili University of Health and Allied Sciences

Introduction

This Consent Form contains information about the research named above. In order to be sure that you are informed about being in this research, we are asking you to read (or have read to you) this Consent Form. You will also be asked to sign it (or make your mark in front of a witness). We will give you a copy of this form. This consent form might contain some words that are unfamiliar to you. Please ask us to explain anything you may not understand

Reason for research

You are being invited to take part in a research project, which aims to assess knowledge of histamine fish poisoning among fish consumers and health care personnel in Dar es Salaam.

Your decision to take part in the study is voluntary and you may refuse to take part or to stop taking part at any time and you may refuse to answer any question asked.

This study has been given approval from the Directorate of research and publication committee of Muhimbili University of Health and Allied Sciences and permission to do research has been obtained from the Regional medical officer in Dar es Salaam region.

Procedure

If you agree to participate, you will be interviewed today. The interviewer will ask you about your demographic characteristics, knowledge on histamine fish poisoning. The interview will take about 15-30min.

Benefit

The information you provide will help us to understand the knowledge level of fish consumers and health care personnel toward histamine fish poisoning. This information will help the relevant authority to design guidelines on proper fish handling by fish vendors and fishermen as well as enlighten the clinicians from misdiagnosing it with fish allergy. Your information will be useful to researchers, policy makers, health professionals, and communities.

Risk/Discomfort

Some of the questions may be sensitive, so you might feel uncomfortable at the same time we are going to take your time.

Alternative

The only alternative is not to take part in this study.

Study withdrawal

You can stop being a study participant at any time. During the interview, you can stop the interview by asking the interviewer to stop. The interviewer may stop you from being in the study if he or she believes you're unable to answer questions because of tiredness.

Cost/Compensation

This exercise is voluntary, therefore there will be no payment given to the patients.

Confidentiality

All the information you provide will be confidential. Code number will identify the information you provide in research record. We will not use your identity in any report or publication about this research.

Questions

In case you have any question(s) you can ask the principle investigator in this study Mr. Ngwegwe Bulula whose phone number is 0713 345 508, Dr. Veronica Mgoyela (supervisor) – 0715 261 532, Dr. Eliangiringa Kaale (supervisor) – 0715 453 847 and Chairman of the College Research and Publications Committee- Prof Muhsin Aboud, P.O Box 65001, Dar-es-salaam, Tel: 2150302-6.

They will be glad to answer any question at any time.

Acceptance

If you have understood and ready to participate please sign below;

Signature of the respondent/or witness.....

APPENDIX V: INFORMED CONSENT (SWAHILI VERSION)

Utafiti kuhusu uelewa juu ya madhara ya “histamine” kwenye samaki kwa wafanyakazi wa afya na walaji wa samaki mkoa wa Dar es salaam.

Mdhamini; Wizara ya Afya na Ustawi wa jamii.

Mimi jina langu ni Ngwegwe Bulula ninatoka Chuo Kikuu cha Afya na Tiba na Elimu ya sayansi Muhimbili.

Kusudi la utafiti

Unakaribishwa kwenye utafiti huu ambao unatafuta kujua uelewa wa walaji wa samaki pamoja na watataamu wa afya juu ya madhara ya “histamine” kwenye samaki.

Uamuzi wa kushiriki katika utafiti huu ni hiari na unaweza kukataa kushiriki au kuacha kushiriki wakati wowote. Unaweza pia kukataa kujibu maswali

Huu utafiti umepitishwa ufanyike na kamati ya bodi ya utafiti ya Chuo Kikuu Cha Afya tiba na Elimu ya Sayansi cha Muhimbili na ruhusa ya kufanya utafiti imetolewa na Mganga Mkuu wa mkoa wa Dar es salaam.

Utaratibu

Kama utakubali kushiriki utaulizwa maswali leo hii.

Msaili atakuuliza maswali kuhusu uelewa wako juu ya madhara ya “histamine” kwenye samaki.

Usaili utachukua kati ya dakika 15 hadi dakika 30.

Manufaa

Maelezo utakayotoa yatatusaidia kujua kiwango cha uelewa cha walaji wa samaki na wataalamu wa afya, na maelezo hayo yanaweza kutumika na taasisi husika kutoa miongozo juu ya utunzaji mzuri wa samaki kwa wavuvi na wauzaji wa rejareja ili kupunguza madhara hayo, pia kwa wataalamu wa afya kutofautisha “allergy” na

madhara hayo ya “histamine” kwenye samaki na hivyo wagonjwa kutibiwa ipasavyo na kupata ushauri sahihi.

Kwa hiyo maelezo yako ni muhimu kwa watafiti, waandaa sera, watumishi wa afya, na jamii kwa ujumla.

Adhari/Adha

Maswali mengine utakayoulizwa yanaweza kukusababishia kujisikia vibaya naomba utuwie radhi, vilevile tutachukua muda wako

Mbadala

Mbadala wa kushiriki kwenye huu utafiti ni kutokushiriki

Kujitoa kwenye utafiti

Unaweza kujitoa kwenye huu utafiti wakati wowote Wakati wa usaili unaweza kumwomba msaili kuacha kukuuliza maswali. Msaili anaweza kuacha kuendelea na usaili kama ataona umechoka na huwezi kujibu maswali.

Gharama/malipo

Hili zoezi zima ni la hiari, kwahiyo hakuna malipo yoyote yatakayotolewa.

Usiri

Maelezo yote utakayotoa Ni ya siri Namba ya siri itatumika katika kuweka kumbukumbu ya maelezo utakayotoa Hatutatumia utambulisho wako tutakapotoa ripoti au kuchapisha matokeo ya utafiti huu

Maswali

Kama una maswali yoyote unaweza kuwauliza wahusika wa utafiti huu ambao ni Mr. Ngwegwe Bulula kwa namba ya simu 0713 345 508, Dr. Veronica Mgoyela namba ya simu 0715 261 532, Dr. Eliangiringa Kaale namba ya simu 0715 453 847 na Mwenyekiti wa kamati ya utafiti na machapisho Chuo Kikuu cha Afya Muhimbili,

Prof Muhsin Aboud wa sanduku la posta 65001, Dar-es-salaam, Simu No: 2150302-

6.

Kukubali

Kama umelewa na uko tayari kushiriki katika utafiti huu tafadhari weka sahihi hapo chini.

Sahihi ya anaaulizwa/Shahidi

.....tarehe.....