USE OF ADEQUATELY IODIZED SALT AT THE HOUSEHOLD IN TEMEKE MUNICIPALITY, TANZANIA.

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Master of Public Health Dissertation
Muhimbili University of Health and Allied Sciences
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USE OF ADEQUATELY IODIZED SALT AT THE HOUSEHOLD IN TEMEKE MUNICIPALITY, TANZANIA.

By

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree for Master of Public Health of Muhimbili University of Health and Allies Sciences.

Muhimbili University of Health and Allied Sciences
October, 2016

CERTIFICATION

The under signed certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allies Science a dissertation entitled " Use of adequately iodized salt at the household in Temeke municipality, Tanzania." In partial fulfillment of the requirements for the degree of master of public Health of Muhimbili University of Allies Sciences

_____

Dr Method Kazaura

(Supervisor)

Date _____

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Special appreciation should go authors who conducted studies were used for references in my study.

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Lastly and most important, I wish to thank my parents who raised me, supported me, taught me and loved me.

DEDICATION

To our loving grand-daughter Amanda, and her parents Dr Emmanuel Mnkeni and Dr Emmaglory Mnkeni.

ABSTRACT:

Introduction

Use of adequately iodized salt at the household level is crucial for prevention of Iodine Deficiency disorders which are vital for public health importance in Tanzania . Iodine concentration in iodized salt used at the household is an important indicator for monitoring level of iodine in it.

Methods

A cross-sectional descriptive study was conducted among heads of heads of household in five wards in Temeke Municipality in Dar –Es- Salaam, Tanzania. Systematic random Sampling was conducted to obtain the study population. Interview was used to collect demographic information from the respondents characterized with age, sex, religion, level of education and source of income. Laboratory analysis for the collected iodized salt samples from the household was performed. Iodine concentration from the samples were identified by use of simple rapid test, for testing iodine from iodized salt. The iodine content in salt samples were measured by using an iodometric titration as described by Maeyer, Lowenstein and Thilly, (1979).The reaction mechanism studied into steps;1.Liberation of iodine from salt(2.titration of free iodine with thiosulphate.

Results

Total 384 of salt samples collected from the household have been tested by use of rapid iodine testing kit and found that 99(25%) have no Iodine, while 285 (75%) have Iodine. Among Iodated samples tested for Iodine proportions 17 (6%) have insufficient iodine content, 258(90.5%) have adequate iodine content, while only 10 (3.5%) have excessive iodine content. The overall median iodated salt obtained was 3.5mg/kg with a range of 0-85mg/kg. Most of respondents interviewed 190(49%) had primary school education while only 58 (15%) had four education level and majority 221 (58%) of them were self employed followed by78 (20%) who depend on their families and friends support. When interviewed, 221 (58%) of respondents mentioned iodized salt to be expensive while most of them,77% have no knowledge about use of adequately iodized salt.

Conclusion and recommendation;

Non iodized salt was used at the household level. Lack of knowledge on use and importance of iodized salt lead to household members use non –iodized salt as they were unable to differentiate between iodized and non- iodized salt. The other reason was Iodized salt was expensive for household members and not readly available.

Household members who used non-iodized salt, used to import from Mainland (Mkoani) especially from Mtwara and Lindi and level of their education was standard seven. Non-iodized salt was easily available at the retail shops with little price compared to iodized salt. The knowledge obtained from these study will assist plan for programme for prevention of IDD, through scaling –up the use of adequately Iodized salt at Temeke Municipal.

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LIST OF ABBREVIATATIONS

BMI	Body mass Index
CDC	Centre for Disease Control
DFID	Department for International Development
DHS	Demographic health survey
ENA	Emergency Nutrition Assessment
FAO	Food & Agriculture Organization
IDA	Iron Deficiency anaemia
ICCID	International council for control of iodine deficiency Disorder
IDDs	Iodine Deficiency Disorders
$KATO_3$	Potassium iodate
MGL	Milligram per liter
MOHS	Ministry of health and Social Welfare
MUAC	Middle upper arm circumference
MUHAS	Muhimbili University of Health And Allied Sciences
NBS	National Bereau of statistics
NNS	National Nutrition survey
PPM	Part Per Million
TDHS	Tanzania Demographic Health Survey
TFNC	Tanzania Food and Nutrition Centre

TRHCS	Tanzania Reproductive and Child Survey
UNICEF	United Nation children's funds
USA	United state of America
VAD	Vitamin A Deficiency
WFP	World Food Programme
WHO	World Health Organization

DEFINITION OF TERMS

Iodized Salt

According to this study, it is the salt which contains 15 parts of iodine per million parts of salt.

Partially Iodized Salt: Contains less than 15 parts of iodine per million parts of salt.

Non-Iodized Salt: Salt that has no iodine which may cause a lot of public health problems such as congenital malformations, still birth, brain damage etc.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BackGround

Globally, 75 percent of households have adequate iodized salt (15 ppm or more), but coverage varies considerably by region. East Asia and the Pacific had the highest coverage, 87% in 2011, and as a region had nearly reached the universal salt iodization target of at least 90 % (UNICEF, 2011). Coverage was lowest in sub-Saharan Africa, where less than half of households have adequate iodized salt.

Coverage is generally higher among richer households than poorer households (UNICEF, 2011). One fifth of countries reporting in 2011 had reached the 90% target of universal salt iodization. Most had reached only 50-70% coverage, which was below the level recommended by WHO, (2007), which required a country to have iodized salt programme and for it to be considered to be iodized, to had reached at least 90% of households used iodized salt (UNICEF, 2011). Household using iodized salt in Latin America & Caribbean was 89% which is below the recommended level by World Health Organization. According to WHO; (2007) which stated that, "for the country's salt iodization programme to be considered iodized to have reached the goal of eliminating iodine deficiency; when at least 90% of households used Iodized salt".

Fortified salt that contain 15 parts of iodine per million parts of salt (ppm) was considered adequately iodized for prevention of iodine deficiency (WHO/UNICEF/ICCIDD; 2007). Moreover, in Africa and Sub-Sahara Africa only 60% use Iodized salt at the households; South Asia (55%); Eastern Asia and Pacific (86%); West and Central Africa (73%); Middle East and North Africa (60%); Eastern and South Africa (48%). (TDHS, 2010). Tanzania is among the countries affected by iodine deficiency disorders in the world. Due to Iodine Deficiency Disorders (IDD) in Tanzania; millions of children fail to reach their potential because they have been deprived of essential mineral especially for Iodine and can lose an average of 13.5 I.Q points which make them exhausted and slow to learn (TDHS, 2010).

The Ministry of Health, Community Development, Gender, Elderly and Children of the United Republic of Tanzania, adopted a National food and Nutrition Policy which focus on four major public health nutritional deficiencies or conditions of which iodine deficiency disorders (IDD) was among them, others were protein energy malnutrition (PEM) Nutrition anaemia and vitamin "A" deficiency (VAD). The recommended iodine levels in household should be 15 PPM and above. Tanzanian's salt iodization standard requires 20 to 80 PPM. This range is based on the fact that iodization levels at the site of production are 40-80 PPM and assumption that 50% may be lost (WHO, 2007).

Research done in the availability of adequate Iodized salt at household level and associated factors in Ethiopia; found that (33%) of the households used adequately iodized salt. The main reason for not using Iodized packed salt were lack of awareness about the benefits (44.2%) being expensive (20%) and difficult to find 25.8%). Also knowledge of households regarding importance of Iodized Salt was obtained from their friends (5.4%); others (0.6%) and Health workers (61%).

The other factor which has contributed to the use of inadequately iodized salt was the behavior of using non iodized salt due to low price and beliefs associated with non iodized salt at the households (Reducing Malnutrition in Tanzania (2014).

1.2 Statement of the problem

The decline in the use of adequately iodized salt at the household is a major public health problem globally. Studies have been conducted in various parts of the world including Tanzania showed that use of adequately iodized salt at the households had declined from required level. In Southern Africa were (48%), Southern Africa alone was 62.4 (THDS, 2010).Knowledge on the use and importance of adequately iodized salt were among the factors contributed to the declined in the use of adequately iodized salt in different parts of the world.

According to Christina, B. and Benjamin, B.(2007), the level of knowledge on the use of adequately iodized salt at the household,78.1% were aware of adequately iodized salt,

72% of respondents knew, not every salt contain iodine,69.3% indicated that inadequate intake of iodized salt might led to development of goiter and 64.6%of respondents indicated that they exclusively used iodized salt for cooking ,the reason given was the price of iodized salt was a little higher than the common salt. Research conducted in Northern Ethiopia ,on the use of adequately iodized salt at the households and associated factors, found that (33%) use adequately and the reasons for not used adequately iodized salt were lack of awareness on the importance of adequately iodized salt and non-iodized and benefits 44.2%.and iodized salt been expensive (25.8%) .According UNICEF (2011), richer households were more likely to access adequately iodized salt as compared to poor households. Iodine proportion in adequately iodized salt was very important for its effectiveness for public health aspects. According to Assey et.al. (2016) the proportion iodine in iodated salt was found to be very poor (less 50%) in three regions of Tanzania namely Lindi, Rukwa and Iringa out of 21 regions. 55% in 58 out of 106 districts had less than (90%) of iodine. Also 16 districts had unsatisfactory proportion of 76% to 90% and 18 districts had poor coverage 50% to 75% and very poor with less than 50% coverage at households level. According Tanzania Food and Nutrition Centre (TFNC), (2014) some of household were found to use non-iodized salt and iodized salt which were readily available at retail shops. Therefore, this research has been planned and conducted to ascertain the extent for use of iodized salt for health promotion.

1.3 Rationale of the study

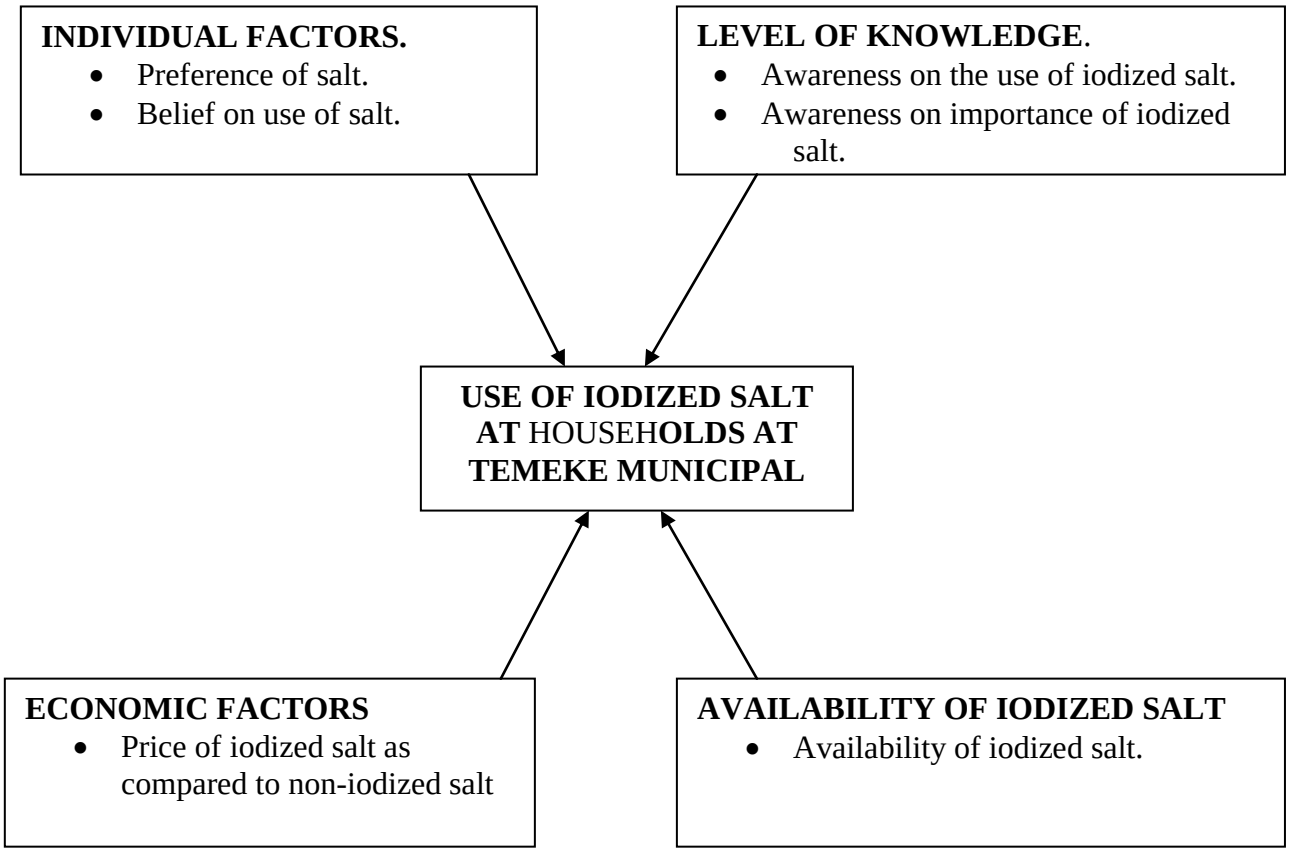
The study was conducted in Temeke Municipal in order to determine the use of adequately iodized salt at the households, the proportion of households used adequately iodized salt, beliefs associated with usage of adequately iodized salt and the level of knowledge on iodized salt and its importance. The findings from the study will be used to plan better programmes for prevention of Iodine Deficiency Disorders (IDD) which is still a National health problem.

Therefore it is crucial to understand the status of usage of adequately iodized salt at the household and knowledge and determinants for inadequate use of iodized salt. The useful of this information will be used in the plan and design of new interventions. This will be

through modification of the determinants and implementation of appropriate measures to scale- up use of adequately iodized salt at the household and ultimately promote health.

1.4 Conceptual Framework

Cultural belief on the use of iodized salt affect intake of adequately iodized salt .The other factors were the price of iodized salt, which lead to the household members to opt for non-iodized salt for their domestic consumption. Knowledge on the importance of iodized salt have contributed to scale –up use of iodized salt. In general the use of adequately iodized salt by household members depends on individual factors such as preference of salt, and beliefs associated with the type of salt used. In this study majority used iodized salt for diseases preventive measures such as goiter. Economic factors such as high price of Iodized salt as compared to non - iodized salt. Likewise, the level of knowledge of household members made them aware on the use of adequately iodized salt and its importance. Availability of iodized salt also has a vital role to play on the use of adequately iodized salt by the household members at Temeke Municipal.



1.5 Research Questions

1. What are the levels of iodine present in salt used at household in Temeke Municipal Dar-es-Salaam, Tanzania?
2. What was the proportion of household used adequately iodized salt at Temeke Municipal at Dar-es-Salaam, Tanzania?
3. What were the beliefs associated to the use of Iodized salt in Temeke Municipal at Dar-es-Salaam, Tanzania?
4. What is the level of knowledge of the household members in Temeke Municipal at Dar –es-Salaam, Tanzania

1.6.1 Broad Objective

To assess the use of adequately iodized salt at households in Temeke Municipal in Dar es Salaam; Region.

1.6.2 Specific Objectives

1. To determine the proportion of households using iodized salt at Temeke Municipal Council, in Dar es Salaam, region-Tanzania.
2. To determine the iodine content in salt used at the households in Temeke Municipal at Dar es Salaam; region-Tanzania
3. To explore the cultural beliefs associated with the use of adequately iodized salt at the households in Temeke Municipal in Dar es Salaam, Region –Tanzania.
4. To determine the level of knowledge of the household members in Temeke Municipal, at Dar-es-Salaam, Tanzania.

CHAPTER TWO

2.0 Literature review

Globally studies have shown that, the use of adequately iodized salt had declined beyond the expected level, set by WHO (WHO, 2007). According to UNICEF (2011) globally, 75% of households used adequately iodized salt at 15ppm or more. East Asia and Pacific Asia had high coverage 87% and 73% ;respectively while South Asia 55% (TDHS; 2010).

Analysis by UNICEF indicated that richer households were more likely to access adequately iodized salt as compared poor households. Availability and use of Iodized salt has adverse effect on all population groups, especially for women of reproductive age (15-49years) who often are the group most affected. Availability and use of Iodized salt is related to adverse pregnant outcomes, such as spontaneous abortion, foetal brain damage and congenital malformation; still birth & perinatal death (THDS; 2010).

Study done on use of adequately Iodized salt at the households and associated factors in communities in Ethiopia found that 33% of the households were utilizing iodized salt and they mentioned the reasons for not using iodized packed salt as lack of awareness on the importance or benefit 44.2% and iodized salt being expensive 25.8%. Knowledge of the household members regarding to the importance of using iodized salt was obtained from friends 5%; from health workers 61% and Radio talks was 33%. The use of iodized salt in the households in Latin America and Caribbean were 89% and sub-Sahara Africa was 60%; West and Central Africa 73%; Middle East and North Africa 60%; The study performed on micronutrients deficiencies including iodine deficiency and other related Factors in Ethiopia; 2009 found that more than two third school aged children 79.5% had at least one mineral Deficiency (MD) and 40.5% had two or more micro nutrients deficiencies. Good nutrition for (micronutrients) especially for iodine helped student showed up at school prepared to learn and make them healthier. Sociologists and economist have looked more, closely to the impact of students diet and nutrition (iodine intake) on academic and behavior outcomes (Sorhaido and Fisher ; (2006).

Iodine deficiency has been recognized as the cause of preventable brain damage in the world. The spectrum of iodine deficiency disorders (IDD) includes mental retardation; hypothyroidism goiter; and varying degrees of other growth and development abnormalities. The World Health Organization (WHO) estimated that over 30% of the World's populations (2 billion people) have Iodine concentrations below 100 mcg/L. moreover; about one –third of school –aged children (6-12yers old) worldwide (241 million children in 2011) had insufficient iodine intake. www.ncbi.ncbi.nih.gov/published/17897900

Thyroid gland diseases vary according to the environment. In sub-Sahara Africa; they are also influenced by population isolation and absence of food self-sufficiency; both factors affecting the onset and persistence of iodine-deficiency goiters. Women are mainly affected (94.2%); most often with enthyroid goiter (54.7%) followed by graves disease (13.1%); hypothyroidism (8.8%) thyroditis (6.6%) toxic miltinodular goiters (6.6%); and unclassified goiters (10%).(www.ncbi.ncbi.nih.gov/puplished/17897900)

In children and adolescents; death rate increase with congenital or acquired thyroiditis as with delayed physical or mental development. In this environment; thyroiditis can also be pregnancy –related. Very recent surveys show a prevalence of endemic goiters of 28.6% in Ethiopia; 64-70%, Sudan; 20-29% in Kwazulu –Natal; 14.3-30.2% in Namibia, 0.21% (Congenital hypothyroidisms or cretinism) Nigeria 55.2% www.ncbi.nih.gov/published/17897900

In Tanzania malnutrition had contributed to an estimated 130 child deaths every day (TDHS, 2010).These children died because their immune systems were weakened through lack of essential micronutrients especially iodine, so they easily succumbed to common childhood diseases, that they would have otherwise be able to fight. Millions of children have failed to reach their potentials, because they have been deprived of essential nutrients for health growth and brain development. According to Reducing Malnutrition in Tanzania report, (2014) has determined that, vitamin and mineral deficiency along, cost Tanzania TZS 650 billion about US$ 390 million in revenue each year which is equivalent to (2.45%) of GDP.

Beliefs may be associated with the use of adequately iodized salt at the household. Some of household members may belief that use of iodized salt lead to problems associated with reproduction especially for female infertility (Reducing Malnutrition in Tanzania,(2014). Hence this study has been designed to explore and find out those beliefs and other associated factors that hinder the use of adequately iodized salt in Temeke Municipal, and assisting the community members by creating awareness on the importance of using iodized for their better outcomes of their reproduction and health in general.

CHAPTER THREE

3.0 STUDY METHODOLOGY

3.1 Type of study

The type of study was cross-sectional. Quantitative and qualitative data had been collected by use of interviewing method for heads of households and Salt samples were collected from each household tested on the spot for iodine by use of rapid iodine testing kit and the results be recorded. The samples that were tested positive during rapid iodine test were further subjected to TFNC laboratory for analysis for determination of iodine concentration.

3.2 Study Area

The study has been conducted at the household in 5 wards at Temeke Municipal in Dar es Salaam region with a population of 1, 611972, (2012, Census) with estimated growth rate of 4.6% and an area of 656sqkm and, is the largest among the three districts of Dar es Salaam region ,with 149,537 households.

3.3Technique for selection of Study population

The study populations were the heads of households at Temeke Municipal selected by Systematic random sampling to obtain 384 household heads. These had been chosen because they were the ones who made choice to buy and use of adequately iodized salt at household level. Interview was conducted for household heads who were not involved during pre-testing of the questionnaires and those who consented to participate in the study. Before interview questionnaires were pre-tested to the few selected heads of the households to check for their validity and reliability. Salt samples were also collected from the households pre-tested on the spot by use of rapid iodine testing kit for detection of iodine in them. Those tested positive for iodine content, i.e. that turned into blue when a drop of iodine thiosulphate dripped in them, were considered iodized. Then the identified iodized samples were further subjected to TFNC laboratory for analysis proportion of iodine in mg/kg in it.

3.3.1 Sample Size Estimation:

The sample size was 384 heads of households in Temeke Municipal who had been interviewed on use of adequately iodized salt at the household .Salt samples were collected from the households had been tested by use of rapid iodine testing kit for iodine, and the result be recorded. .Slightly large samples had been followed that of iodine rapid tested especially those tested positive for further laboratory analysis for iodine concentration at TFNC laboratory and sample size estimation had been obtained by use of formula of proportion as follows:

$$n = \frac{Z^2 P (1-P)}{\varepsilon^2}$$

Where:

Z = Critical value at 95% (1.96) Confident interval

P = Expected proportion of household using iodized salt in Temeke Municipal Council (in this case was taken 0.5)

Ɛ = Marginal error (precision) expected proportion with characteristic of interest from previous studies or pilot study.

For Temeke P, is not known, hence, P 50% was be used for a given marginal errors.

$$\text{Therefore} = \frac{1.96^2 \times 0.5^2}{(0.05)^2} = 384$$

$$n = \mathbf{\underline{384}}$$

The sample size for this study was 384

3.4 Inclusion and Exclusion Criteria

Inclusion Criteria:

The household heads that consented to participate in the study at Temeke Municipal.

Exclusion Criteria:

The household heads that involved for pre-testing of the questionnaires in order to avoid biasness of answers provided by them.

3.5 Recruitment of research assistants

The principal investigator had recruited five research assistants for data collection from the heads of households. The research assistants were middle age gentlemen graduated with education background in social work. Training was conducted by principal investigator on the familiarization of research purpose, data collection tools and sampling techniques.

3.6 Data collection method and tools

Questionnaires consisted of open and closed ended questions were used for interviewing heads of household at Temeke Municipal. Salt samples had been tested for iodine by use of iodine rapid testing kit for salt samples provided by heads of households and the results been recorded on the spot. Salt that turned to blue or purple after drop of the test solution be dripped on the salt; was considered to be iodized. Adequately iodized salt was defined as salt with an iodine content of ≥15 parts per million (PPM) of iodine (WHO, 2007).

Secondly, the research team asked for a slightly large sample of salt from the household heads that had been put into a screwed-capped plastic container and been labeled appropriately then transported to the TFNC laboratory to be tested for Iodine content. The laboratory analysis of these salt samples have been performed by use of titration described in the training manual; of laboratory and quality assurance Procedures of Universal salt Iodization Program (WHO; 2007; MI and ICCIDD; 2009) The iodine content in iodized salt was been estimated by a process called iodometric titration; in which free iodine from the potassium iodate compound in salt reacted with sodium thiosulfate by use of starch as

an external indicator. After process of titration, the results obtained were recorded for interpretation and for report writing.

3.7 Plan For Salt Analysis For Iodine ;

To perform the analysis 10 grams of salt were weighed and put in a stoppered conical flask. The salt was added to 50ml of distilled water; and flask was been shaken gently on a laboratory shaker to dissolve the salt. To the salt solution; 1ml of 2N sulphuric acid was added followed by 1ml of potassium iodide using a dispenser. The flask was been restoppered. A changed colour of the salt solution from colourless to yellow indicated the prescence of iodine. The flask containing the salt/acid mixture was been kept in the dark for 10minutes to avoid exposure to light. Then; the mixture was titrated with 0.005N sodium thiosulphate was continued until the purple colour became colourless. The volume of sodium thiosulphate used in the titration was read off the burette and reading was compared to volumes in table with pre-calculated volumes that corresponded with iodine values.

The recommended iodine levels in the households should be 15 PPM and above (WHO; 2007). According to United Republic of Tanzania; (2010) Tanzania's salt iodization standards require 20 to 80 PPM.

This range has been based on the fact that iodations levels at the site of production needed to be 40-80 ppm and assumption that (50%) might be lost before reaching the consumer (United Republic of Tanzania 2010). However; in this study; result has been expressed according to the WHO standards to have allowed their comparison with National data. Furthermore; contribution of iodine levels in the range of 10 PPM to less than 15 PPM would be discussed in this study

3.8 INDEPENDENT VARIABLES: DEPENDENT VARIABLE:

- Age.
- Income source — Use of Iodized salt
- Knowledge of households heads.
- Beliefs.

- Availability of iodized salt.

3.10 Pre-testing of questionnaire;

3.11 Validity and reliability of questionnaire

As part of establish reliability and validity of the instrument the questionnaire were pre-tested to 38 heads of household who would not be included in the study. Principal investigator and the research assistants have pre-tested six questionnaires each, one which showed repetitions have been removed and skiped pattern which seem to confuse respondents had been omitted by adding responses which captured all who were supposed to be skiped the question the adjustment had been made to enable proper collection of indented information.

3.11 Data Processing

The absorbance data had then is entered into the computer with multi-calc, programme, which plotted them against a standard curve with known amounts of iodine to obtained iodine concentration in Mg/L of each specimen. Data obtained from questionnaires were summarized and presented into histogram and pie chart showing the status for use of iodized salt at the household level. Data obtained from questionnaires were summarized, then coded and analyze by the use of SPSS computer programme to obtain frequencies which were presented into pie chart and histogram for clear meaning.

Data obtained from questionnaires in to demographic information were summarized to make table showing frequencies and percentages for each variable. Other samples which required laboratory investigation for iodine concentration,were titrated at the laborator yand result be tabulated in mg/litre .

3.12 Data analysis plan

Before tested; each s sample was given a laboratory number and logged into a specifically developed CSPro Test Tracking System (CHTTS) database.

3.13 Ethical consideration

The researcher had obtained the ethical clearance from MUHAS which had allowed the study to be conducted at Temeke Municipal. The ethical clearance had been submitted to the Temeke Municipal Director who wrote a letter which had permitted the researcher to have conducted the research to the specified Wards. The household s were entered after the permission obtained from the Ward Executive Officers (WEO), then the researcher visited the selected households and explained to them clearly about the research and requested them to have participated in the study and together planned the day for interview. Any household which did not consented would not be forced to participate in the study.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio demographic characteristics:

A total of 384 households heads were recruited for the study, among them 47 (12%) were male and 337 (88%) were female. Most of participants 147 (38%) were of the age between 36 to 45 years and had primary education only 190 (49%). The source of income of household heads 222 (58%), were self- employed, followed by employed, 85 (22%) while only 78 (20%) had other sources of income like family and friends' support.

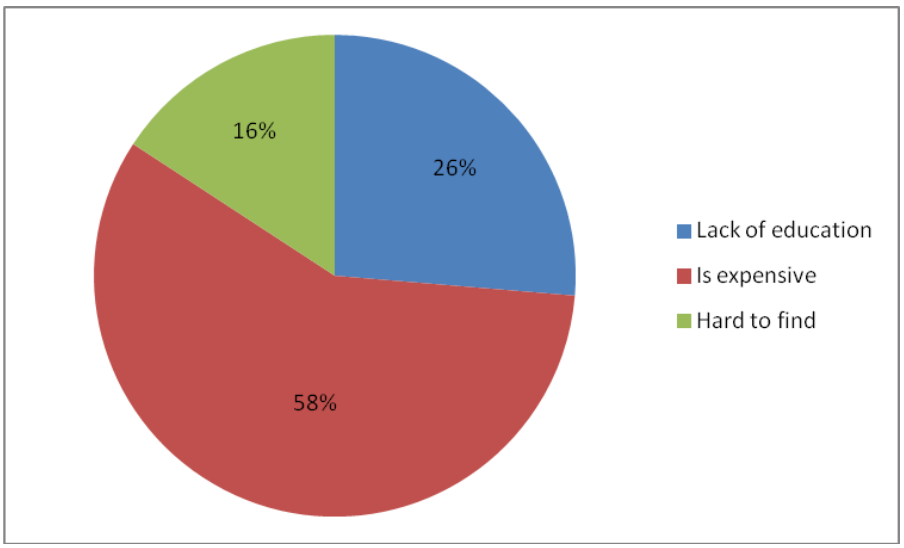
Table 1: Socio demographic characteristics of 384households in Temeke Municipal

DEMOGRAPHICS		**n**	**(%)**
Gender	Male	47	(12)
	Female	337	(88)
Age group distribution	16 – 25	82	(21)
	26 – 35	101	(27)
	36 – 45	147	(38)
	46 – 55	33	(9)
	56– 65	11	(3)
	66+	10	(3)
Level of education	Primary	190	(49)
	Form Four	58	(15)
	Form Six	60	(16)
	Others	71	(20)
Source of income			
	Employed	85	(22)
	Self-employed	221	(58)
	Others	78	(20)

Availability of iodized salt:

Research participants were asked about the availability of iodized salt, 365 (95%) said they had no problem in obtaining iodized salt, while 19 (5%) had problems. Among them, their main problem was purchasing power, 11 (58%) and those who said iodized salt was expensive were 5 (26%) compared to those 3(16%) who had no knowledge on iodized salt.

Figure 1: Problems associated iodized salt



Proportion of utilization of salt and iodized salt at the household in Temeke Municipal

Respondents provided small amount of salt which was tested for iodine to establish its presence in the salt. Those samples which tested positive by iodine rapid testing kit, were sent to TFNC laboratory to establish the iodine concentration in part per million. Salt samples of 384 were tested for iodine content using rapid iodine tester and the results were 285 (75%) samples had iodine while 99 (25%) had no iodine.

The iodine concentration in the salts used by households in Temeke Municipal:

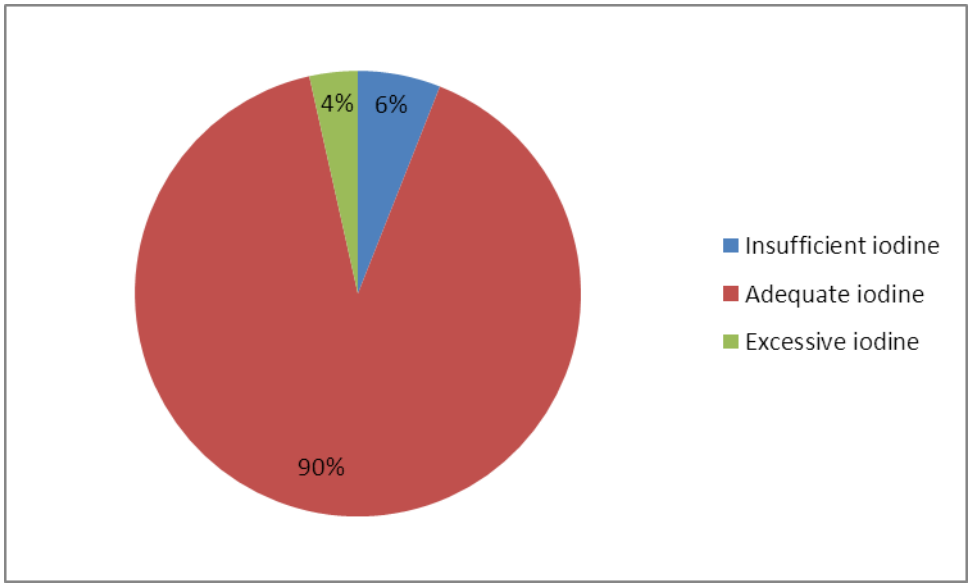
285 salt samples were sent to TFNC laboratory for establish the iodine concentration in the salt. The laboratory results were categorized as shown below in terms of public health significance.

Table 2: Iodine content, proportions and categories of public health significance

Category	**Number (%)**	**Public health significance**
Below 15.0mg/kg	17 (6.0)	Insufficient iodine content
≥15.0 – 60.0mg/kg	258 (90.5)	Adequate content
≥ 60.0mg/kg	10 (3.5)	Excessive iodine content
	285 (100.0|)	

A total of 258 (90%) of the samples had adequate iodine, 17 samples (6%) had insufficient iodine while 10 samples (4%) had excessive iodine content. The results were summarized as shown below

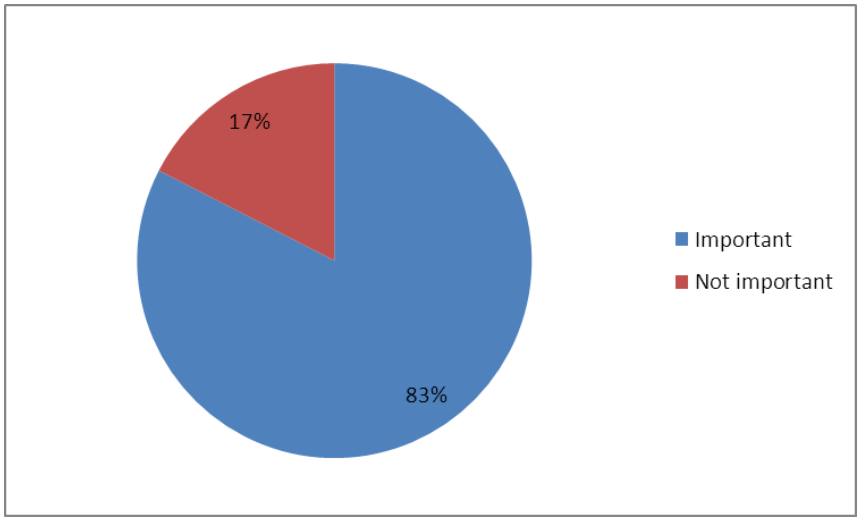
Figure 3: Iodine concentration in terms of public health significant



Knowledge and importance of iodized salt:

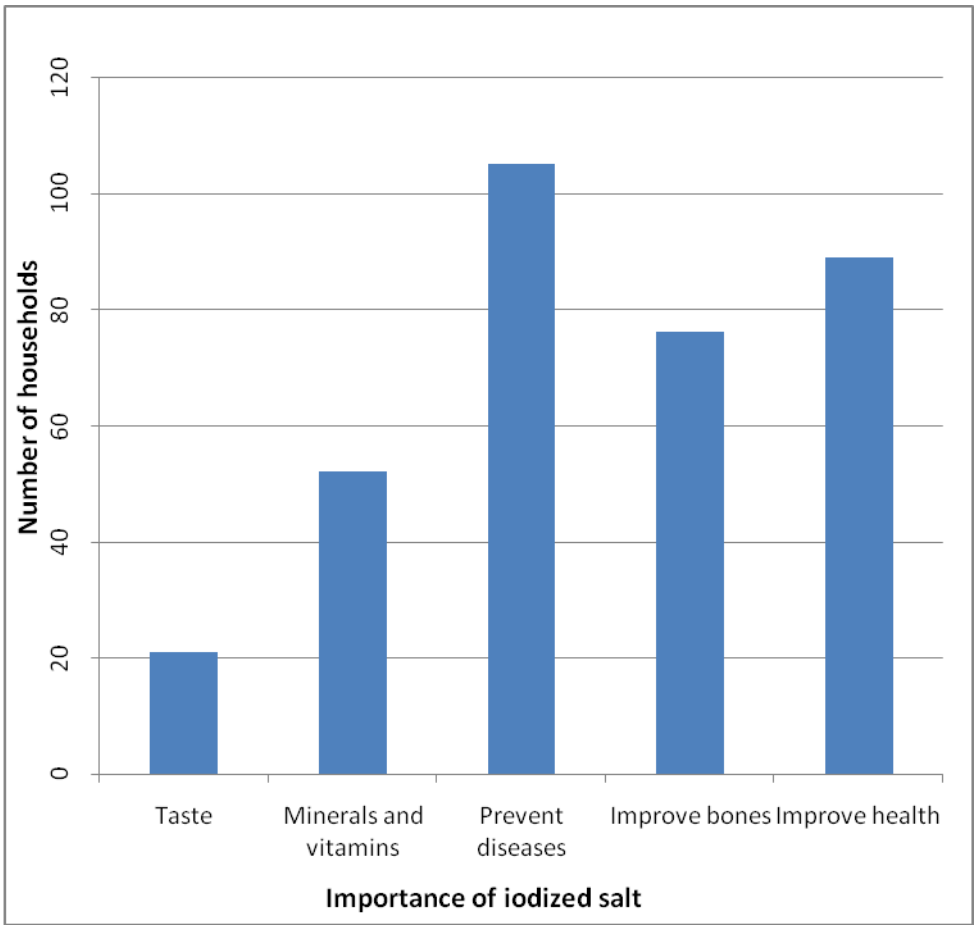
To establish the importance of iodized salt in the household, participant were asked two questions. One was asking the importance of using iodized salt and the second question asked about the effects of not using iodized salt. The questions were open-ended questions; they had no limit on the number of importance or effects. The results were divided into two groups, one group included all who stated at least one importance or effect and the second group had all who could not state any importance or effect plus those who said they know nothing about iodized salt. 317 (83%) said iodized salt was important while 67 (17%) saw no different between iodized salt and other salt or they did not know the importance (iodized salt was not important). Figure 4

Figure 4: The knowledge on importance of iodized salt.



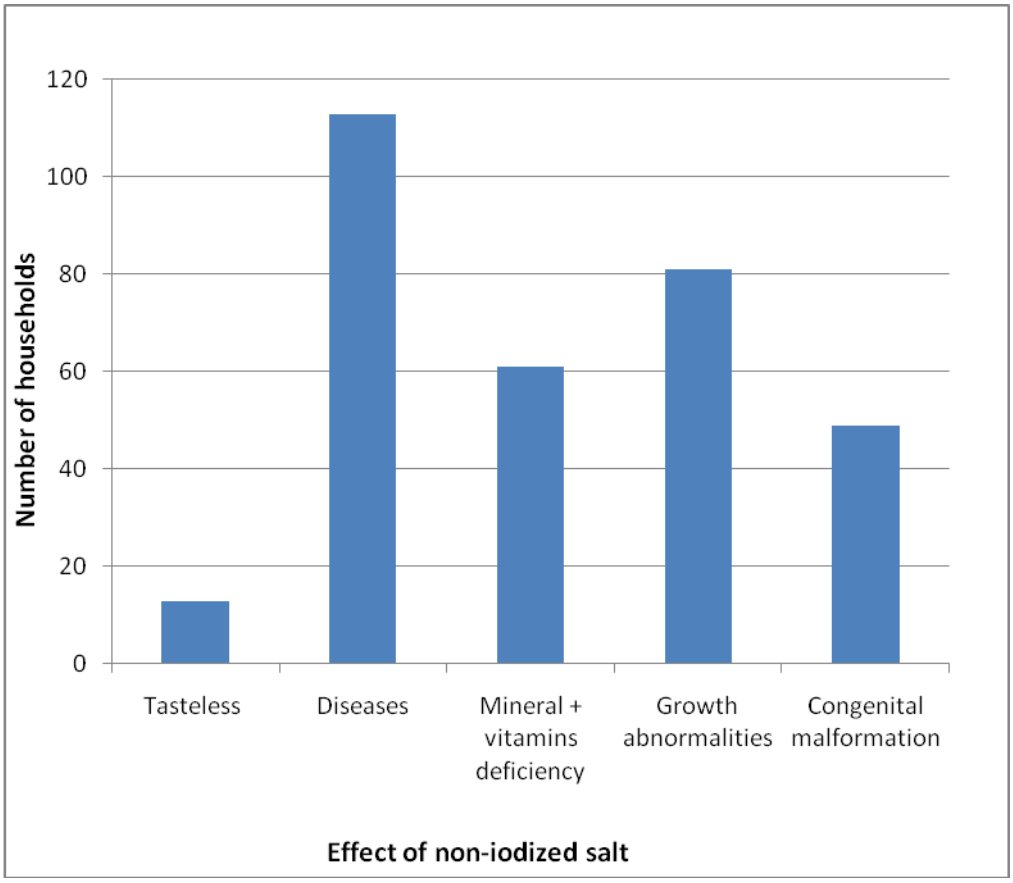
Majority of the household heads interviewed, said iodized salt prevents diseases (27%) followed by improves health (23%) and bones (20%) respectively. Minority said it gives food taste (6%) while 10% said they do not know the importance of iodized salt as shown below in Figure 5

Figure 5: Different uses of iodized salts.



The following were identifies as the effects of not using iodized salts: tasteless in food, diseases, minerals and vitamins deficiencies, growth and development abnormalities and congenital malformations. The highest or the most frequent mentioned effect was diseases (29%), growth abnormalities (21%) followed by minerals and vitamins and congenital malformations 16% and 13% respectively. 18% of households said they do not know the effects of not using iodized salts.

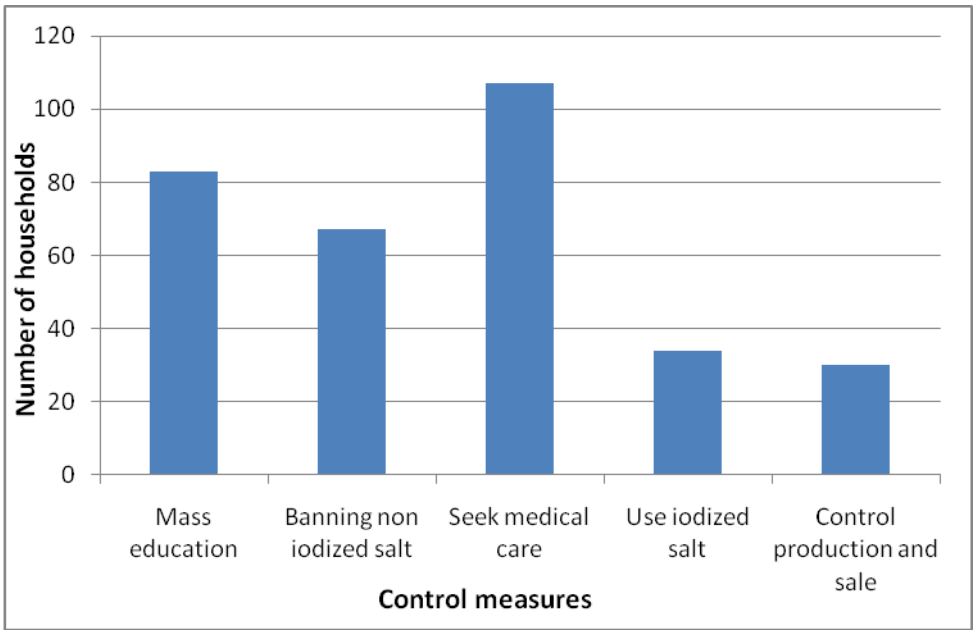
Figure 6: effects of using non-iodized salts



Among

the diseases identified in this study were goiter 25 (22%), hookworm diseases 12 (11%) and bone deformities 76 (67%) as shown in figure7.

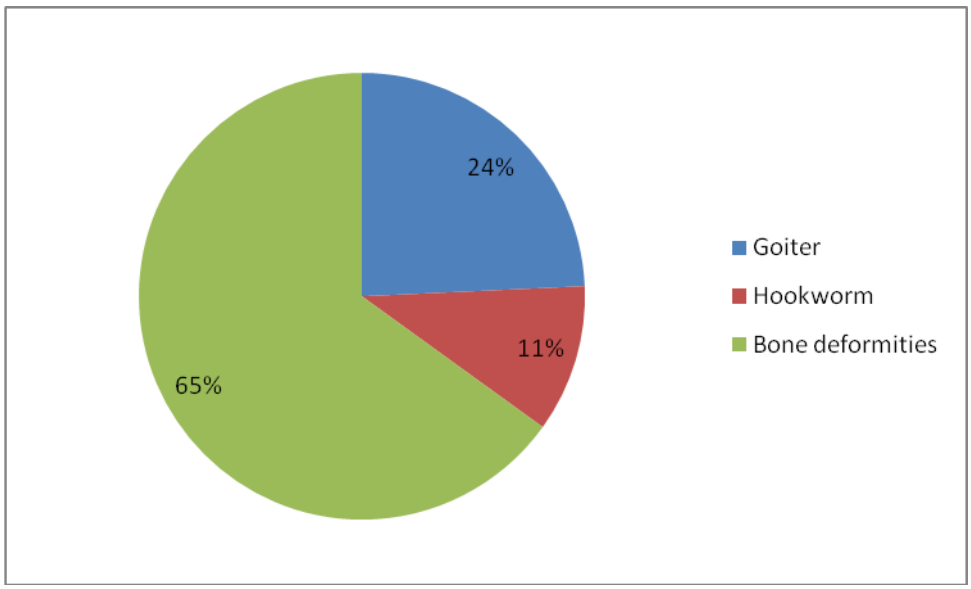
Figure 7: Methods of controlling non-iodized salts



Several measures were identified by the households members both corrective and preventive for not using iodized salt. Between them 321(84%) were aware on how to control and prevent the effects compared to,63(16%) who were not aware on how to correct and prevent the effects not use iodized salt.

Most of respondents 250(65%) interviewed said use of non-iodized salt causes bone deformities compared to 92(24%) and 42(11%) who said to cause goiter and hookworm diseases.

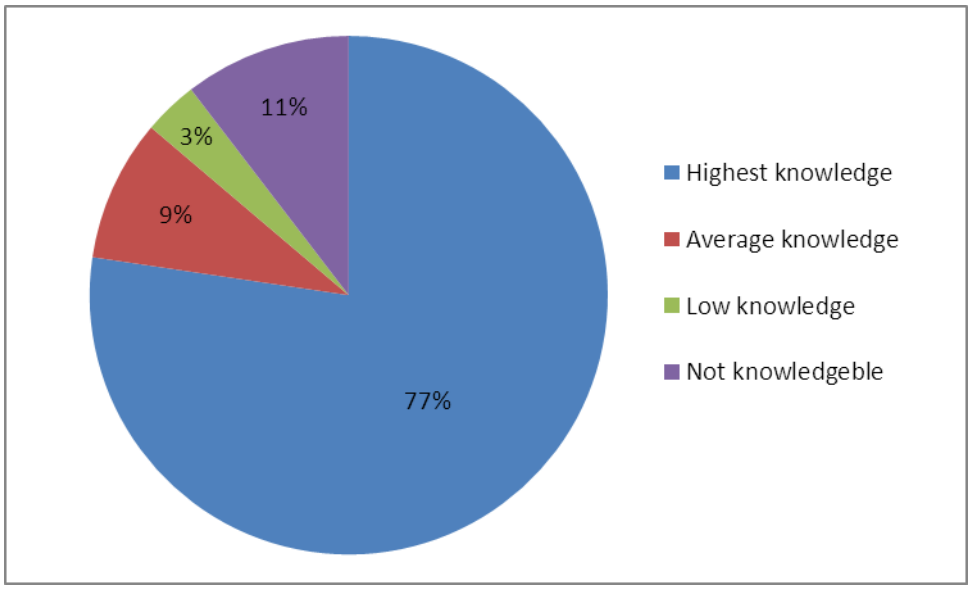
Figure 8: Diseases identified due to non-iodized salt.



Level of knowledge of the respondents, were ranked according to their promtness awareness on iodized salt.

The level of knowledge on the use of iodized salt was based on three points: aware of the importance of iodized salt, effects of non-iodized salt and corrective and preventive measures. The score of three (3) was given to the highest level of knowledge while zero was given to the lowest. Highest knowledge was obtained by being aware of all three points, average knowledge by being aware of two of the three points, lowest knowledge by knowing only one point and no knowledge by knowing none regarding the importance, effects and control measures.

Figure 9: The knowledge levels using iodized salts.



Cultural beliefs associated with the use of iodized salt:

Almost all of the participants did not express or raise any cultural belief that is associated with the use of iodized salt. Only 7 (2%) of households had beliefs. 5 of the 7 households said iodized salt causes high blood pressure (high BP) while the remaining 2 said it was not good for health. They could not explain how iodized salt is related to either high blood pressure or ill health.

CHAPTER FIVE

DISCUSSION

In this study low proportion of household members in Temeke use insufficient iodized salt .Household members who live in urban areas where iodize salt is readily available, have an opportunity to buy and use it for their domestic consumption. Studies conducted in Tanzania with regard to proportion of households using adequately iodized salt , found that intake of iodized salt was low at the household level. (Assey.V, et.al.(2003).Also, WHO estimated that 45% of the population of Eastern Africa was iodine insufficient . The study conducted in Temeke Municipal has demonstrated an impressive improvement in iodine nutrition in Temeke Municipal 12 years after the initiation of the Universal Salt Iodization(USI). Tanzania has moved from a situation where an estimated 25% of its population was vulnerable to iodine deficiency to one where 84% consume Iodized-salt, although this has not reached 90% set by (WHO, 2007) .The re-enforcement regulations by the Tanzania Food and Drug Authority(TFDA) lead to retail shops owner adhere to sell Iodized salt at their shops. Regular shops inspections were been conducted by (TFDA) in cooperation with health department at Municipal level. The other reason was that, in Temeke like any urban areas of Tanzania ,the residence were employed and business people who have ability to buy and use adequately salt According Assey.D,et. al.(2003), there are some exceptions; for example, Lindi and Mtwara regions reported low Iodized-salt coverage , but very low goitre prevalence. There are other areas where concordance is poor in the other direction, for example Mbeya where Iodized salt, are all high while in Rukwa region there was low Iodized-salt coverage .

In many areas weaknesses in salt quality assurance in salt production that include inconsistencies in salt/iodate mixing, consumer's preference for uncontrolled backyard salt production, and non-adherence to salt regulations by salt producers and traders are reflected in low coverage of Iodized-salt and in the high or low levels of iodine . The coverage of Iodized-salt at household level obtained using test kit method in this study and in our previous study showed its concordance with data suggest that, despite some concerns about the reliability of the kits, they can be a useful indicator for program monitoring, allowing for large samples to be assessed at a reasonable cost . However, the kit can be used only to detect the presence or absence of iodine, not amounts added.

In this study also noted some reasons for iodine variations which lead to iodized salt to lose its iodine content. This can directed to small-scale salt producers who no ability to buy the required compound for mixing with salt to obtain adequately iodized salt showed poor coverage of iodized salt and a high proportion of individuals to use iodized at low level like in this study where household members a quarter them use non iodized salt, indicating inadequate dietary iodine intake leading to Iodine Deficiency Disorders(IDD) including brain damage, can occur unless iodine enters the food chain through addition of iodine to foods.

The difficulty of providing a continuous supply of potassium iodate and the poor iodation technologies in many small-scale salt producers could be one of the factors in the shortage of Iodized-salt in households and the iodine variability observed in the use of adequately Iodized at Temeke Municipal council.

In this study, few of household members use iodized salt with excessive iodine intakes as were observed during laboratory analysis of the iodized samples among the total samples submitted in this study first was from those living close to salt factories at Temeke Municipal, second scenario to those people living in commercial centres with access to Iodized-salt direct from the factory that has not passed through the steps in the salt marketing chain known to cause iodine loss (Temeke in the Dar es Salaam area), and third was in those people living along the the shore of Indian Ocean where dried fish products are commonly consumed and preservation was usually with Iodized-salt (Tandika and Mtoni ward respectively). However, despite of the fact that Temeke Municipal Council with high access to marine/ seaweeds and fish may have high iodine intake, earlier research in Tanzania has reported inadequate iodine status in other areas with easy access to these foods.

Inadequate quality control of iodation at salt producing factories may contribute to the problem. It is likely that lower factory salt iodation levels, guidelines for which have recently been harmonized at 40 - 60 ppm in the Eastern and Southern Africa region, will reduce the prevalence of excessive iodine intake .

In this study some members of household lack on identification and importance of iodized salt. Some of them think that there is no difference between non-iodized salt and iodized salt. According to Christiana.B, and Benjamin. B, revealed that there has been a remarkable improvement in knowledge about iodized salt compared with the findings of a study conducted by the University of Ghana in collaboration with the Ministry of Health, Ghana, from 1991-1993 on IDDs in Ghana that 98% of the respondents had no knowledge about iodized salt . The improvement has occurred as a result of the Food and Drugs Board amendment Act, Act 523 of 1996 on universal salt iodization and the propagation of health education by the Ministry of Health and the Ghana Health Service creating awareness about the importance of iodized salt. The increase in the knowledge levels over the years suggests that, if awareness creation and educational activities are sustained mainly in the local dialects, it is likely that all Ghanaians would become aware of iodized salt and its importance to human health and wellbeing.

A significant proportion of the respondents (39.9%) indicated that their major source of information about iodized salt was the radio, which could be attributed to the high number of radio stations in the country, especially the three stations in the Bia District. A similar study conducted among rural households also revealed that over 95% of the study participants knew about iodized salt and IDDs mostly through educational programmes broadcast on radios and televisions. Forty two respondents, representing 16.6% indicated that the television and health workers were their main sources of information regarding iodized salt. This low percentage could also be attributed to the fact that majority of the people in Bia are settler farmers who live on their cocoa farms and as such are not likely to have access to public health educational messages propagated through the electronic media

or by health workers in the communities. These findings suggest that even though the use of the electronic media is one effective way to improve and sustain peoples' use of iodized salt, settler cocoa farmers, a considerable section of the population in the district, are likely to be left out and may not have access to these educational programmes.

The findings regarding why the intake of iodized salt is important show an improvement over the findings of a similar study conducted by Asibey-Berko (1995) in 30 selected districts from all the ten regions of Ghana within a period of three years (1992-1995) in which it was reported that 1.1% and 0.4% of the respondents indicated that iodized salt prevents goitre and improves the overall health of the individual respectively. It can be inferred that as a result of increased knowledge regarding the importance of using iodized salt and the effects of its deficiency in the diet of an individual, there has also been an increase in the consumption rate of iodized salt . The knowledge levels of respondents can be described as above average, reflected in the responses of 72% of the respondents who indicated that every salt does not contain iodine. Similarly, the majority of the respondents knew that inadequate intake of iodized salt resulted in the development of goitre. On the other hand, 60% of the respondents indicated that the taste of iodized salt is different from that of common salt, corroborating the report of a similar study conducted in Mongolia, that more than half of the study participants indicated that the taste of iodized salt was not the same as that of common salt. However, in a double-blind study using the same respondents, it was revealed that they could not distinguish the taste differences between iodized and uniodized salt. This misconception regarding the differences between the taste of common salt and iodized salt should be corrected through educational messages, particularly because it can act as a barrier and prevent people from using iodized salt.

Some non-users and occasional users (respondents who used both common salt and iodized salt) reported that common salt was cheaper compared with iodized salt, which influenced their decision in choosing common salt. This finding is supported by a similar study which also reported that the majority of occasional users and non-users of iodized salt indicated that the price of iodized salt was slightly higher than that of common salt [3]. As asserted by Yamada et al. (1998) generally, iodized salt costs more than common salt because of the additional processing cost involved in fortifying common salt with iodine.

A high proportion (57%) of the respondents knew that the iodine content of iodized salt reduces when it is not stored in enclosed containers, by virtue of its volatile characteristic. The findings of a study conducted by Sebotse et al. (2009) indicated that when iodized salt was not stored in closed plastic bags, sealed waterproof materials or closed containers, iodine losses occurred leading to a reduction in the iodine content of the salt before it is consumed.

The finding that 75.6% of respondents consumed iodized salt indicates a slight reduction in the intake of iodized salt compared with the Western Regional Annual Health Sector Report based on that year's household survey which revealed that approximately 77% of the people living in Bia district consumed iodized salt. The present finding suggests that the initial effort by health workers and other collaborators in the dissemination of information to sensitize and create awareness about the importance of consuming iodized salt might be declining. Similarly, it is likely that programmes broadcast through radio stations are also declining. The implication of these findings is that if health education activities are not stepped- up, this downward trend will continue. Other reasons that have been given for the failure of most developing countries to achieve 90% utilization of

iodized salt include political factors and logistical problems in the production and distribution of iodized salt.

Beliefs and practices have a vital role to play in the use of iodized salt in this study. Although very few household members had beliefs on the use iodized salt, instead described both health benefits and risks related to salt intake. Some of their positive perceptions have been influenced by public health promotion of iodized salt and oral rehydration solution. The few negative perceptions were also influenced by preventive messages from the health care providers for those with hypertension. The cultural perspectives such as beliefs and practices presented in this study have, to my knowledge, never been previously reported. Understanding the existing perceptions and beliefs that affect the patterns of salt use by household members will contribute in designing strategies for reduction of salt intake at this level.

Historically, salt has played an important role in human society. The value placed on salt is evident by its use in religious ceremonies, cuisines and premise to conquer land . In the Indian subcontinent, introduction of salt taxes led to the movement against British colonial rule that culminated in independence of India in 1947. Respondents in our study described the religious and cultural significance of salt in their community. Other researchers have reported that foods are often part of the cultural identity of a region and community. The availability and accessibility of salt in our study area may have influenced the evolution of food culture. Similar findings have been shown in others studies conducted in Bangladesh and elsewhere. Our respondents stated that one of the primary functions of salt is enhancing the flavour of food. Researchers have shown that despite people being used to a certain taste of food, salt used can be reduced about 30% - 50% in composite dishes

without significantly reducing acceptability of the dish]. In contrast others have mentioned that people need time to get used to low salt food. In our study there are some indications that the beliefs about benefits of salt were influenced by knowledge derived from public health activities. This demonstrates that individual and cultural beliefs around food, including salt is a dynamic process and can change based on personal experience and exposure to biomedical knowledge. To craft future salt reduction strategies it is important to consider both beneficial and harmful aspects of salt and how to convey this information for maximum benefit to population health.

It is now known that excess salt consumption is associated with various cardiovascular and other diseases. Excess sodium intake promotes left ventricular hypertrophy as well as fibrosis in the heart, kidney, and arteries. In our study area people at large did not recognize that excess salt consumption is harmful which reflects inadequate biomedical knowledge. However, some of the people in this community knew that salt intake is linked to hypertension indicating that biomedical knowledge of this link, in a limited way, has reached the community. Despite having the knowledge of the link between salt intake and hypertension, people in our study believed that cooking processes can render salt harmless to health. This is an example of medical knowledge being interpreted by people to validate their pre-existing ideas about salt intake, health and illness]. It also could be that people prioritize taste over knowledge of detrimental effects of food in selecting foods to eat as found in other studies. Most theories of health behaviour propose that people who have a good understanding of biomedical knowledge tend to take action to use the knowledge to remain healthy. It is vital, therefore, that recommendations about salt reduction are

designed with the understanding of existing cultural beliefs so that people can clearly understand the recommendations and potential benefits associated with them.

One particular important issue to consider is people's awareness about salt content in their foods. For instance, in developed countries researchers reported that many people did not recognize the "hidden" presence of salt in processed foods . In contrast, our respondents were aware that salt is added in many foods even if they do not taste salty. The difference in the findings reflects the differing context because in our study area most foods were prepared at home and people were mostly aware of what has been added to their food. This attribute is largely lost in societies eating a preponderance of processed food. But there is an analogy in the population we studied to Western unawareness of salt in processed foods: In our study area, respondents did not recognize that salt can occur naturally in both foods and water. Due to global warming and climate change induced saline intrusion, salinity in drinking water and foods may have already surpassed permissible levels in the exposed coasts of Bangladesh which is becoming an increasingly important health issue. Salt intake through drinking water could result in about 1.1g/day of sodium intake according to a calculation based on mean sodium levels in drinking water. It is important therefore, that in coastal areas with Beliefs and practices have a vital role to play in the use of iodized salt in this study. According to Sabrina.Rasheed, et. al (2016) revealed that salt is as an essential component of food with strong cultural and religious roots. The deep rooted values and meanings associated with use of salt in food indicate that implementation of salt reduction strategies in our study community will be a challenge. In the study community people described both health benefits and risks related to salt intake. Some of the positive perceptions have been influenced by public health promotion of iodized salt and oral

rehydration solution. The few negative perceptions were also influenced by preventive messages from the health care providers for those with hypertension. The cultural perspectives such as beliefs and practices presented in this study have, to our knowledge, never been previously reported in Bangladesh. Understanding the existing perceptions and beliefs that affect the patterns of salt use by household members will contribute in designing strategies for reduction of salt intake at this level.

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to consider both beneficial and harmful aspects of salt and how to convey this information for maximum benefit to population health.

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One particular important issue to consider is people's awareness about salt content in their foods. For instance, in developed countries researchers reported that many people did not recognize the "hidden" presence of salt in processed foods. In contrast, our respondents were aware that salt is added in many foods even if they do not taste salty. The difference in the findings reflects the differing context because in our study area most foods were

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According to the recent Bangladesh national survey (2011) 19.4% males and 31.9% of females over 35 years of age are hypertensive and this trend is expected grow. Climate change induced saline intrusion has already affected the lives over 20 million people living in the exposed coast of Bangladesh, which may be responsible for the significantly higher proportion of hypertension observed among people living in the coastal area compared to those living in other areas. It is imperative therefore, to formulate policies and specific programs in the coastal areas focused on reducing population-level salt intake. It is also important to formulate campaigns to increase consumer awareness of the link between salt intake and health problems. The modifiable behavioural factors which also influence increased salt consumption should be given importance in designing tailored salt reduction strategies.

The strength of our study was the use of both qualitative and quantitative methodologies to assess the use of salt from the community perspectives. While qualitative enquiry provided us with a rich description of the context in which salt consumption took place in Chakaria, the quantitative data provided some understanding of the dimension of the problem. In terms of the limitations, our study was conducted in Chakaria and does not represent the entire population of Bangladesh. However, some of the findings related to access and use of salt may be applicable for other coastal areas in Bangladdesh This in-depth community-based study revealed a similar result as was obtained in other studies but the overall level of iodization of salt at the consumer level was far from the target of 90% in West Bengal.

The iodine concentration of salt in the rural households was lower than that in the urban households. The similar differences were reported by other studies in India (and in other countries . It was even lower among those who were unaware of its significance and among the socially- and economically-disadvantaged population. Other reports stated that the consumption of iodized salt varied in respect of socioeconomic condition . Studies in Bangladesh reported that the economic status of households was related to the consumption of iodized salt. Thus, the vulnerable groups are still being exposed to under- or non-iodized salt.

Besides the rural-urban difference and the difference by religion and caste, other factors at the household level which resulted in unequal access to iodized salt were lack of awareness about IDDs, iodized salt and its benefit, purchase of loose salt, and improper practice of storage. Studies by other researchers also reported the similar observation of unequal access to iodized salt. Lack of knowledge about the link between the use of iodized salt and IDDs and the high cost of iodized salt appeared as correlates of low consumption of

iodized salt . Studies in other parts of the world have also documented the important influence of knowledge on willingness to purchase and use iodized salt.

We found almost an equal proportion of salt being adequately iodized at the households (72.9%) and retail outlets (71.7%). This might have an overall influence to equitable access to adequately-iodized salt. A recent study in Orissa reported the use of 45% and 47.7% of adequately-iodized salts at the households and retail outlets respectively.

Twenty-five percent of shops still sell inadequately-iodized salt. Loose salts, mostly being inadequately iodized, are sold at a cheaper cost. Ban on the production and sale of non-iodized salt also appeared to be not being effectively enforced. Moreover, the perceptions of the majority (58%) of the retail shop-owners about iodized salt and IDDs were generally incorrect. Besides other factors at the consumer level, all these factors at the retail shop level might also have contributed to less access to iodized salt in the area.

Consumption of adequately-iodized salt at the household level is substantially below the expected level of 90%. The salt-iodization programme had less access to cover those who are less aware of its importance, who are socially and economically disadvantaged, and who follow the improper practice of storage. In this context, the state IDD-control programme needs to emphasize on the improvement of the salt-iodization coverage, implement ban on the production and sale of non-iodized salt, subsidize the production and distribution of iodized salt, and focus awareness-generation campaign for the socially- and economically-disadvantaged population and shop-owners for increasing the consumption and sale of iodized salt and also for good practice of storage.

STUDY LIMITATIONS

Due to the behavior of household heads of using non- iodized salt the information obtained when interviewed weather they are using iodated salt , the information obtained result into desirability bias due to fear of been counted not using adequately iodized salt. High prices for iodated salt lead to the household heads opt for cheaper salt (non-iodated salt) than iodated one. Also because of lack of knowledge on the importance on use of adequately iodized salt, which they mention it as expensive and sometimes difficult to get, some of the household heads opted for non iodated salt for their domestic consumption.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

This study substantiates that a quarter of household members use non-iodated salt. The reasons mentioned by them are , iodated salt is difficult to get when needed, and expensive for them. This is possible for the manufactured salt to be expensive because the compound which is being used for mixing is sold very expensive for salt minners which caused them to the manufactured salt expensive to wholesalers who in turn sale retailers ,and for the sell to consumers at high price. Lack of awareness on the importance of using adequately iodated salt mentioned as one of the reasons for not using adequately iodized salt. This study also find out that, members of households lack knowledge on iodized salt, they could not distinguish between iodated salt and non-iodated .They think salt is salt whether iodized or not . Lack of awareness on the effects of not using adequately iodated salt, make them import from inland such as from (Mtwara and Lindi) salt from this regions have poor iodine contents. In this study the findings reflect that household members use iodated salt with iodine concentration which is below the level recommended by Tanzania s salt iodization standard which require 20 to 80 ppm. This range is based on the fact that iodization at the site of production are 40-80ppm and the assumption that at least50% may be lost before reaching the consumer.(United Republic of Tanzania, 2010). This study highlights that, household members are not knowledgeable on which in shops is iodized be retail shops have varieties of salt with different prices customer the one desired by him and most probably buy the cheap one. In retail shops non iodated salts are not packed in packets, sold by use of different containers with different volumes and weights such of half a liter or liter, half of a kilogramme or a kilogramme and glasses or tins are used.

1.2 RECOMMENDATION

Since the use of iodized salt at the household level in Temeke is declaiming which also give rise of use of non-iodated salt health education to create awareness of the importance of use of adequately iodated salt at household level with the focus in presentation of nutrition related micronutrients deficiency in especially iodine Use of adequately iodized salt is mainly focus on presentation of iodine deficiency disease (IDD) and its adverse effects include mental and physical congenital defects in newborns, low learning capacity , impaired growth and poor health and low productivity among general population
Health Education programs to create awareness in the use of adequately iodized salt should be planned to use the local government system through the existed nutrition steering committees which are from municipal levels to the street levels

This should starts at municipal level by having advocacy meeting with the municipal nutritional steering committees and its members are counselors, heads of departments and nutritionists. After this meeting we go to the ward levels to create awareness to the ward nutrition steering committee (WNC) and streets steering committee. These committees have extension works from various departments and together with community health workers. Community health worker will be used to create awareness at the household level while those at the ward level will act as TOTS for community health workers.

During the training leaflets, booklets, flares, magazines, radio, televisions needs to be used to convey the message to the household on the importance of the use of iodated salt. Also in the time with this, the ministry of Health and social welfare of the United Republic of Tanzania adopted a national food and nutritional policy in 1992 which recognize the importance of good health to national developments and link between national and good health. The focus is on the prevention of nutrition related decease and condition through provision of adequate nutrition sound food especially for iodized salt used in the household and fortification of food together with provision of health education on the importance of using adequately iodized salt through television , leaflets, and health talks provide at facilities and through schools during health education

Apart from that, regular inspection of wholesale and retail shops need to be performed in order to identify non-iodized salt and strictly measures to be taken on the spot which include fines and imprisonment together with revokement of the license. The government need to remove tax to the businessman who imported the chemical for mixing to have iodated salt, so that salt miners who can buy in low price for mixing hence can reduce the price of mixed (iodated salt for retailer shops) hence low price for household members who u their conception

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Appendix –1: Questionnaire (English version)

QUESTIONNAIRE FOR ASSESSING USE OF IODATED SALT AMONG HOUSEHOLD MEMBERS IN TEMEKE MUNICIPALITY

Questionnaire # [ ]

Date: ……..

A. Social demographic characteristics

1. How old are you? .....
2. What is your gender?
    1. Male
    2. Female
3. What is your religious affiliation?
    1. Muslim
    2. Christian
    3. Others; (please specify)…….
4. What is your level of education?
    1. Primary school education
    2. Ordinary level secondary education
    3. Advanced level secondary education
    4. Others (please mention)……
5. What is your main source of income?
    1. Formally employed
    2. Informally employed
    3. Others (please mention)…….
6. Which ward do you live in Temeke Municipal? .....

B. **The following questions ask about iodine content in salt used by household members at Temeke Municicipal.**

6.1. Do you used salt for cooking purposes?

1. YES
2. NO

6.2. Can you give us small portion of salt for rapid testing for iodine and for laboratory testing for iodine concentration?

1. YES
2. NO

6.2.1. Rapid iodine testing for salt provided.

Turn blue or purple 1. YES
2. NO

6.2.2 If yes, the portion is then collected and placed in plastic bin which can be screwed to open or close to avoid iodine loss of the salt.

6.2.2. T.F.NC Laboratory analysis of the iodized samples for concentration of iodine from iodized salt samples. The concentration of iodine in sample was performed and a report was produced.

C. The following questions ask about cultural beliefs associated with the use of iodized salt among households members.

7. In your area, do have any cultural beliefs prohibiting use of iodized salt?

1. YES
2. NO

7.1. IF the answer is YES, above please provide the statement of belief .....

……

……

D. The following questions will be asked for the level of knowledge of the households members on importance of using iodized salt.

8. What are the importance of using iodized?

9. How do you know the salt you buy have no iodine?

……

……

10. What effect for a family which do not use iodized salt?

……

……

……

11. What do you can be done to correct the situation?

……

……

……

THANK YOU FOR YOUR CO-OPERATION

Appendex 2: Questionnaire (Swahili version)

DODOSO KUHUSU MATUMIZI YA CHUMVI YENYE MADINI JOTO KWA WATU WAISHIO KATIKA KAYA MANISPAA YA TEMEKE

Namba ya dodoso _____

Tarehe.....

A. TAARIFA BINAFSI ZA MDODOSWA

1. Je una umri gani? .....
2. Jinsia yako
    1. Mwanaume
    2. Mwanamke
3. Dini yako
    1. Muislam
    2. Mkristo
    3. Nyingine (tafadhali eleza)……..
4. Una kiwango gani cha elimu?
    1. Elimu ya darasa la saba
    2. Elimu ya kidato cha nne
    3. Elimu ya kidato cha sita
    4. Nyingine (tafadhali eleza)……
5. Chanzo chako cha kipato ni nini?
    1. Nimeajiriwa
    2. Nimejiajiri
    3. Kingine (tafadhali eleza)…….
6. Unaishi Kata gani? .....

B. Maswali yafuatayo yataulizwa juu ya kiasi cha madini joto kilichoko kwenye chumvi itumikayo katika Kaya Manispaa ya Temeke.

7. Je, unaweza kutupatia kiasi kidogo cha chumvi ili tuipime kama ina madini joto?

    1. NDIYO
    2. HAPANA

7.1. Kama jibu ni ndiyo tafadhali naomba unipatie kiasi kidogo cha chumvi, ili tuipime kama ina madini joto.

7.1.1. Chumvi iliyopimwa madini joto.

MAJIBU: MADINI JOTO: 1. NDIYO

2. HAPANA

7.2. Je, kuna shida yeyote katika kupata chumvi yenye madini joto?

1. NDIYO
2. HAPANA

7.3 Kama jibu ni ndiyo unafikiri kifanyike nini ili kuondoa shida hiyo?

……..

…….

C. Maswali yafuatayo yatauliza juu ya Kaya zitumiazo chumvi yenye madini joto.

8. Katika Kaya yako mnatumia chumvi yenye madini joto?

    1. NDIYO
    2. HAPANA

8.1 Kama jibu ni ndiyo, tafadhali naomba kiasi kidogo kinachozidi kile cha kwanza ili nipeleke maabara kwa uchunguzi kama ina kiasi gani cha madini joto.

8.2. Uchunguzi maabara ya TFNC juu ya uwepo wa madini joto.

1. NDIYO
2. HAPANA

D. Maswali yafuatayo yatauliza juu ya uwepo wa mila zinazozuia matumizi ya chumvi yenye madini joto.

9. Je, kuna mila zozote zinazozuia matumizi ya chumvi yenye madini joto?
    1. NDIYO
    2. HAPANA
10. Kama jibu hapo juu ni ndiyo,tafadhali eleza inaelezaje hayo makatazo.

……

……

E. **Maswali yafuatayo yatauliza juu ya elimu ya umuhimu wa madini joto katika chumvi ya kupikia**.

11. Je, huwa unatumia chumvi yenye madini joto?
    1. NDIYO
    2. HAPANA
12. Kama jibu ni ndiyo, je, kuna umuhimu wowote wa kutumia chumvi yenye madini joto? Tafadhali eleza

……

……

……

13. Je, kuna madhara gani anayeweza kupata mtu asiyetumia chumvi yenye madini joto (Tafadhali eleza)

……

……

13.1. Je, madhara yatokanayo na kutotumia chumvi yenye madini joto yanaweza Yakashughulikiwaje? Tafadhali eleza.

……

……

ASANTE KWA USHIRIKIANO WAKO

Appendix 3 :Informed consent, English Version

MUHIMBILI UNIVERSITY COLLEGE OF HEALTH SCIENCES, DIRECTORATE OF RESEARCH & PUBLICATIONS.

ID-NO ☐☐☐

- **Consent to participate in this study**

  Hi, my name is Rebman Kombe. I am working on research with objective of determining use of iodized salt among household members at Temeke Municipal.

- **Purpose of study:** This has a purpose of collecting information on the use of iodized salt among household members in Temeke Municipal. This study identifies cultural beliefs associated with the use of iodized salt at Temeke Municipal; in DSM. You are being asked to participate in this study because you have particular knowledge and experiences that may be important to the study as well as helping your fellow household members to use iodized salt for their health.

- **What participation involved**

  If you agree to participate in this study, the following will occur:-

  1. You will be interviewed to obtain the information relating to the use of iodized salt.
  2. No identifying information will be collected from you, during this interview, except your age, religion and gender.
  3. The interview will not take more than 15 minutes to answer.

- **Confidentiality:** I assure you that all information collected from you will be kept confidential. Only people working in this research study will have access to the information. We will be compiling a report which will contain responses from several heads of households without any reference to individuals. We will not put any of your identifying information on the records of information you provide.

RISK: We do not expect any harm to happen to you as a result of participating in this study.

Right to withdraw and alternatives:

It is voluntary for to participate in this study. You can choose not to participate in this study and refusal will not involve any penalty or loss of any benefits.

Benefits:

The information that you provide will give a better understanding of households using iodized salt in Temeke Municipal.

In case of injury

We do not anticipate that any harm will occur to you or your family as a result of participating in this study.

Who to contact

If you ever have questions about this study; please contact principal investigator; Rebman Willbard, Muhimbili University of Health and Allied Sciences (MUHAS); P.O.BOX 65001; Dar es Salaam. If you ever have questions about rights as a participant you may call Prof. Said Aboud; Chairperson of college research and publication communities;

P.O.BOX 65001; Dar es Salaam

Tel 2150302-6

Signature

I_____ have read/understood the contents in this form. My, questions have been answered I agree to participate in this study.

Signature of participant_____

Signature of principal investigator_____

Date of signed consent_____

Appendix 4: Informed consent (Swahili version)

MUHIMBILI UNIVERSITY COLLEGE OF HEALTH SCIENCES; DIRECTORATE OF RESEARCH AND PUBLICATIONS

FOMU YA RIDHAA

Namba ya utambulisho ☐☐☐

Ridhaa ya kushiriki katika utafiti huu.

Habari! Jina langu naitwa Rebman Kombe. Nakusanya takwimu kwa ajili ya utafiti kuhusu matuizi ya chumvi yenye madini joto katika Kaya zilizoko Manispaa ya Temeke.

Malengo ya utafiti:

Utafiti huu una lengo la kuangalia kiwango cha matumizi ya chumvi yenye madini joto katika Kaya Manispaa ya Temeke.

Unombwa kushiriki katika utafiti huu kwa sababu mchango wako utakao toa katika kujibu maswali yetu, utatumika kuboresha upatikanaji wa chumvi yenye madini joto katika Kaya zilizoko Mainispaa ya Temeke.

Ushiriki:

Ili kushiriki katika utafiti huu, inabidi kukubali kujiunga kwa kujibu maswali toka kwenye muongozo wa maswali yaliotungwa kwa ajiliya utafiti huu.

Usiri:

Nakuhakikishia kwamba taarifa zote zitakazo kusanywa kutoka kwako zitakuwa ni siri, ni watu wanaofanya kazi katika utafiti huu tu ndiyo wanaweza kuziona taarifa hizi. Hatutaweka taarifa yoyote ya utambulisho kwenye kumbukumbu za taarifa utakazotupa.

Madhara:

Hakuna hatari yoyote itakayoweza kutokewa kwa kushiriki kwako katika utafiti huu.

Faida:

Taarifa utakazotupa, zitasaidia kuongeza ufahamu juu ya matumizi ya chumvi yenye madini joto katika Kaya zilizoko katika Manispaa ya Temeke.

Endapo utadhurika:

Hatutegemei madhara yoyote kwa kushiriki kwako katika tafiti hii.

Watu wa kuwasiliana nao.

Kama una maswali katika utafiti huu, unaweza kuwasiliana na mratibu mkuu wa utafiti Rebman W. Kombe.

Chuo kikuu cha Muhimbili; S.L.P 65001 Dar es Salaam. Kama utakuwa na maswali yoyote kuhusu haki zako kama mshiriki unaweza kupiga simu kwa Prof. M. Aboud ambaye ni Mwenyekiti wa kamati ya chuo ya utafiti na machapisho; S.L.P 65001 Dar es Salaam, simu namba 2150302-6.

Sahihi

Mimi_____nimesoma/nimeilewa hii fomu, maswali yangu yamejibiwa. Nakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki_____

Sahihi ya mtafiti_____

Tarehe ya makubaliano_____

Appendix 5: Laboratory analysis results for salt samples

TABLE II: RESULTS OF SALT SAMPLES COLLECTED FROM TEMEKE MUNICIPAL

Lab. No	Sample No.	Iodine in mg/kg	Lab. No	Sample No.	Iodine in mg/kg
1	**01Tmk**	0.0	44	**44Tmk**	21.0
2	**02Tmk**	37.0	45	**45Tmk**	26.5
3	**03Tmk**	63.5	46	**46Tmk**	31.5
4	**04Tmk**	26.5	47	**47Tmk**	63.0
5	**05Tmk**	26.5	48	**48Tmk**	21.0
6	**06Tmk**	26.5	49	**49Tmk**	31.5
7	**07Tmk**	47.5	50	**50Tmk**	42.5
8	**08Tmk**	26.5	51	**51Tmk**	37.0
9	**09Tmk**	21.0	52	**52Tmk**	26.5
10	**10Tmk**	31.5	53	**53Tmk**	32.0
11	**11Tmk**	37.0	54	**54Tmk**	26.5
12	**12Tmk**	42.0	55	**55Tmk**	26.5
13	**13Tmk**	31.5	56	**56Tmk**	10.5
14	**14Tmk**	42.5	57	**57Tmk**	32.0
15	**15Tmk**	26.5	58	**58Tmk**	37.0
16	**16Tmk**	42.0	59	**59Tmk**	31.5
17	**17Tmk**	21.0	60	**60Tmk**	26.5
18	**18Tmk**	37.0	61	**61Tmk**	26.5
19	**19Tmk**	31.5	62	**62Tmk**	47.5
20	**20Tmk**	53.0	63	**63Tmk**	26.5
21	**21Tmk**	0.0	64	**64Tmk**	5.5
22	**22Tmk**	42.5	65	**65Tmk**	26.5
23	**23Tmk**	42.5	66	**66Tmk**	31.5

24	**24Tmk**	26.5	67	**67Tmk**	37.0
25	**25Tmk**	21.0	68	**68Tmk**	42.0
26	**26Tmk**	31.5	69	**69Tmk**	47.5
27	**27Tmk**	26.5	70	**70Tmk**	42.5
28	**28Tmk**	21.0	71	**71Tmk**	16.0
29	**29Tmk**	31.5	72	**72Tmk**	31.5
30	**30Tmk**	47.5	73	**73Tmk**	53.0
31	**31Tmk**	31.5	74	**74Tmk**	37.0
32	**32Tmk**	26.5	75	**75Tmk**	47.5
33	**33Tmk**	31.5	76	**76Tmk**	26.5
34	**34Tmk**	47.5	77	**77Tmk**	32.0
35	**35Tmk**	5.5	78	**78Tmk**	26.5
36	**36Tmk**	53.0	79	**79Tmk**	26.5
37	**37Tmk**	31.5	80	**80Tmk**	63.5
38	**38Tmk**	31.5	81	**81Tmk**	37.0
39	**39Tmk**	37.0	82	**82Tmk**	47.5
40	**40Tmk**	31.5	83	**83Tmk**	31.5
41	**41Tmk**	26.5	84	**84Tmk**	31.5
42	**42Tmk**	69.0	85	**85Tmk**	21.0
43	**43Tmk**	26.5	86	**86Tmk**	21.0
Lab. No	**Sample No.**	**Iodine in mg/kg**	**Lab. No**	**Sample No.**	**Iodine in mg/kg**
87	**87Tmk**	26.5	131	**131Tmk**	42.5
88	**88Tmk**	42.5	132	**132Tmk**	10.5
89	**89Tmk**	26.5	133	**133Tmk**	26.5
90	**90Tmk**	26.5	134	**134Tmk**	26.5
91	**91Tmk**	47.5	135	**135Tmk**	37.0
92	**92Tmk**	31.5	136	**136Tmk**	11.0
93	**93Tmk**	16.0	137	**137Tmk**	58.0

94	**94Tmk**	31.5
95	**95Tmk**	21.0
96	**96Tmk**	31.5
97	**97Tmk**	26.5
98	**98Tmk**	37.0
99	**99Tmk**	0.0
100	**100Tmk**	31.5
101	**101Tmk**	21.0
102	**102Tmk**	47.5
103	**103Tmk**	21.0
104	**104Tmk**	21.0
105	**105Tmk**	16.0
106	**106Tmk**	31.5
107	**107Tmk**	42.5
108	**108Tmk**	16.0
109	**109Tmk**	21.0
110	**110Tmk**	37.0
111	**111Tmk**	26.5
112	**112Tmk**	21.0
113	**113Tmk**	63.5
114	**114Tmk**	16.0
115	**115Tmk**	31.5
116	**116Tmk**	26.5
117	**117Tmk**	16.0
118	**118Tmk**	21.0
119	**119Tmk**	26.5
120	**120Tmk**	16.0
121	**121Tmk**	37.0
122	**122Tmk**	31.5
123	**123Tmk**	42.5

138	**138Tmk**	26.5
139	**139Tmk**	47.5
140	**140Tmk**	31.5
141	**141Tmk**	47.5
142	**142Tmk**	47.5
143	**143Tmk**	26.5
144	**144Tmk**	63.0
145	**145Tmk**	37.0
146	**146Tmk**	26.5
147	**147Tmk**	53.0
148	**148Tmk**	37.0
149	**149Tmk**	31.5
150	**150Tmk**	21.0
151	**151Tmk**	42.0
152	**152Tmk**	21.0
153	**153Tmk**	21.0
154	**154Tmk**	37.0
155	**155Tmk**	37.0
156	**156Tmk**	37.0
157	**157Tmk**	21.0
158	**158Tmk**	21.0
159	**159Tmk**	21.0
160	**160Tmk**	37.0
161	**161Tmk**	16.0
162	**162Tmk**	16.0
163	**163Tmk**	26.5
164	**164Tmk**	21.0
165	**165Tmk**	31.5
166	**166Tmk**	37.0
167	**167Tmk**	26.5

124	**124Tmk**	31.5	168	**168Tmk**	26.5
125	**125Tmk**	16.0	169	**169Tmk**	31.5
126	**126Tmk**	26.5	170	**170Tmk**	26.5
127	**127Tmk**	31.5	171	**171Tmk**	26.5
128	**128Tmk**	47.5	172	**172Tmk**	26.5
129	**129Tmk**	31.5	173	**173Tmk**	37.0
130	**130Tmk**	32.0	174	**174Tmk**	10.5

Lab. No	**Sample No.**	**Iodine in mg/kg**	**Lab. No**	**Sample No.**	**Iodine in mg/kg**
175	**175Tmk**	42.0	218	**218Tmk**	21.0
176	**176Tmk**	47.5	219	**219Tmk**	37.0
177	**177Tmk**	21.0	220	**220Tmk**	31.5
178	**178Tmk**	26.5	221	**221Tmk**	21.0
179	**179Tmk**	26.5	222	**222Tmk**	31.5
180	**180Tmk**	21.0	223	**223Tmk**	21.0
181	**181Tmk**	21.0	224	**224Tmk**	21.0
182	**182Tmk**	16.0	225	**225Tmk**	10.5
183	**183Tmk**	21.0	226	**226Tmk**	21.0
184	**184Tmk**	16.0	227	**227Tmk**	47.5
185	**185Tmk**	31.5	228	**228Tmk**	26.5
186	**186Tmk**	31.5	229	**229Tmk**	58.0
187	**187Tmk**	31.5	230	**230Tmk**	21.0
188	**188Tmk**	10.5	231	**231Tmk**	63.5
189	**189Tmk**	21.0	232	**232Tmk**	32.0
190	**190Tmk**	37.0	233	**233Tmk**	32.0
191	**191Tmk**	16.0	234	**234Tmk**	31.5
192	**192Tmk**	26.5	235	**235Tmk**	21.0
193	**193Tmk**	37.0	236	**236Tmk**	31.5

194	**194Tmk**	37.0
195	**195Tmk**	21.0
196	**196Tmk**	21.0
197	**197Tmk**	21.0
198	**198Tmk**	31.5
199	**199Tmk**	42.0
200	**200Tmk**	69.0
201	**201Tmk**	26.5
202	**202Tmk**	26.5
203	**203Tmk**	26.5
204	**204Tmk**	21.0
205	**205Tmk**	63.0
206	**206Tmk**	26.5
207	**207Tmk**	21.0
208	**208Tmk**	16.0
209	**209Tmk**	21.0
210	**210Tmk**	21.0
211	**211Tmk**	26.5
212	**212Tmk**	21.0
213	**213Tmk**	31.5
214	**214Tmk**	16.0
215	**215Tmk**	26.5
216	**216Tmk**	31.5
217	**217Tmk**	31.5
Lab. No	**Sample No.**	**Iodine in mg/kg**
261	**261Tmk**	26.5
262	**262Tmk**	37.0
263	**263Tmk**	47.5

237	**237Tmk**	21.0
238	**238Tmk**	26.5
239	**239Tmk**	26.5
240	**240Tmk**	21.0
241	**241Tmk**	37.0
242	**242Tmk**	31.5
243	**243Tmk**	37.0
244	**244Tmk**	47.5
245	**245Tmk**	47.5
246	**246Tmk**	0.0
247	**247Tmk**	31.5
248	**248Tmk**	37.0
249	**249Tmk**	53.0
250	**250Tmk**	21.0
251	**251Tmk**	21.0
252	**252Tmk**	37.0
253	**253Tmk**	21.0
254	**254Tmk**	37.0
255	**255Tmk**	21.0
256	**256Tmk**	31.5
257	**257Tmk**	42.5
258	**258Tmk**	32.0
259	**259Tmk**	37.0
260	**260Tmk**	0.0

264	**264Tmk**	26.5
265	**265Tmk**	37.0
266	**266Tmk**	31.5
267	**267Tmk**	26.5
268	**268Tmk**	85.0
269	**269Tmk**	47.5
270	**270Tmk**	26.5
271	**271Tmk**	47.5
272	**272Tmk**	5.5
273	**273Tmk**	5.5
274	**274Tmk**	21.0
275	**275Tmk**	0.0
276	**276Tmk**	0.0
277	**277Tmk**	26.5
278	**278Tmk**	37.0
279	**279Tmk**	42.5
280	**280Tmk**	21.0
281	**281Tmk**	42.5
282	**282Tmk**	47.5
283	**283Tmk**	26.5
284	**284Tmk**	37.0
285	**285Tmk**	37.0

TABLE II: RESULTS OF SALT SAMPLES COLLECTED FROM TEMEKE MUNICIPAL

Lab. No	Sample No.	Iodine in mg/kg		Lab. No	Sample No.	Iodine in mg/kg
1	**01Tmk**	0.0		44	**44Tmk**	21.0
2	**02Tmk**	37.0		45	**45Tmk**	26.5
3	**03Tmk**	63.5		46	**46Tmk**	31.5
4	**04Tmk**	26.5		47	**47Tmk**	63.0
5	**05Tmk**	26.5		48	**48Tmk**	21.0
6	**06Tmk**	26.5		49	**49Tmk**	31.5
7	**07Tmk**	47.5		50	**50Tmk**	42.5
8	**08Tmk**	26.5		51	**51Tmk**	37.0
9	**09Tmk**	21.0		52	**52Tmk**	26.5
10	**10Tmk**	31.5		53	**53Tmk**	32.0
11	**11Tmk**	37.0		54	**54Tmk**	26.5
12	**12Tmk**	42.0		55	**55Tmk**	26.5
13	**13Tmk**	31.5		56	**56Tmk**	10.5
14	**14Tmk**	42.5		57	**57Tmk**	32.0
15	**15Tmk**	26.5		58	**58Tmk**	37.0
16	**16Tmk**	42.0		59	**59Tmk**	31.5
17	**17Tmk**	21.0		60	**60Tmk**	26.5
18	**18Tmk**	37.0		61	**61Tmk**	26.5
19	**19Tmk**	31.5		62	**62Tmk**	47.5
20	**20Tmk**	53.0		63	**63Tmk**	26.5
21	**21Tmk**	0.0		64	**64Tmk**	5.5
22	**22Tmk**	42.5		65	**65Tmk**	26.5
23	**23Tmk**	42.5		66	**66Tmk**	31.5

24	**24Tmk**	26.5	67	**67Tmk**	37.0
25	**25Tmk**	21.0	68	**68Tmk**	42.0
26	**26Tmk**	31.5	69	**69Tmk**	47.5
27	**27Tmk**	26.5	70	**70Tmk**	42.5
28	**28Tmk**	21.0	71	**71Tmk**	16.0
29	**29Tmk**	31.5	72	**72Tmk**	31.5
30	**30Tmk**	47.5	73	**73Tmk**	53.0
31	**31Tmk**	31.5	74	**74Tmk**	37.0
32	**32Tmk**	26.5	75	**75Tmk**	47.5
33	**33Tmk**	31.5	76	**76Tmk**	26.5
34	**34Tmk**	47.5	77	**77Tmk**	32.0
35	**35Tmk**	5.5	78	**78Tmk**	26.5
36	**36Tmk**	53.0	79	**79Tmk**	26.5
37	**37Tmk**	31.5	80	**80Tmk**	63.5
38	**38Tmk**	31.5	81	**81Tmk**	37.0
39	**39Tmk**	37.0	82	**82Tmk**	47.5
40	**40Tmk**	31.5	83	**83Tmk**	31.5
41	**41Tmk**	26.5	84	**84Tmk**	31.5
42	**42Tmk**	69.0	85	**85Tmk**	21.0
43	**43Tmk**	26.5	86	**86Tmk**	21.0
Lab. No	**Sample No.**	**Iodine in mg/kg**	**Lab. No**	**Sample No.**	**Iodine in mg/kg**
87	**87Tmk**	26.5	131	**131Tmk**	42.5
88	**88Tmk**	42.5	132	**132Tmk**	10.5
89	**89Tmk**	26.5	133	**133Tmk**	26.5
90	**90Tmk**	26.5	134	**134Tmk**	26.5
91	**91Tmk**	47.5	135	**135Tmk**	37.0
92	**92Tmk**	31.5	136	**136Tmk**	11.0
93	**93Tmk**	16.0	137	**137Tmk**	58.0

94	**94Tmk**	31.5	138	**138Tmk**	26.5
95	**95Tmk**	21.0	139	**139Tmk**	47.5
96	**96Tmk**	31.5	140	**140Tmk**	31.5
97	**97Tmk**	26.5	141	**141Tmk**	47.5
98	**98Tmk**	37.0	142	**142Tmk**	47.5
99	**99Tmk**	0.0	143	**143Tmk**	26.5
100	**100Tmk**	31.5	144	**144Tmk**	63.0
101	**101Tmk**	21.0	145	**145Tmk**	37.0
102	**102Tmk**	47.5	146	**146Tmk**	26.5
103	**103Tmk**	21.0	147	**147Tmk**	53.0
104	**104Tmk**	21.0	148	**148Tmk**	37.0
105	**105Tmk**	16.0	149	**149Tmk**	31.5
106	**106Tmk**	31.5	150	**150Tmk**	21.0
107	**107Tmk**	42.5	151	**151Tmk**	42.0
108	**108Tmk**	16.0	152	**152Tmk**	21.0
109	**109Tmk**	21.0	153	**153Tmk**	21.0
110	**110Tmk**	37.0	154	**154Tmk**	37.0
111	**111Tmk**	26.5	155	**155Tmk**	37.0
112	**112Tmk**	21.0	156	**156Tmk**	37.0
113	**113Tmk**	63.5	157	**157Tmk**	21.0
114	**114Tmk**	16.0	158	**158Tmk**	21.0
115	**115Tmk**	31.5	159	**159Tmk**	21.0
116	**116Tmk**	26.5	160	**160Tmk**	37.0
117	**117Tmk**	16.0	161	**161Tmk**	16.0
118	**118Tmk**	21.0	162	**162Tmk**	16.0
119	**119Tmk**	26.5	163	**163Tmk**	26.5
120	**120Tmk**	16.0	164	**164Tmk**	21.0
121	**121Tmk**	37.0	165	**165Tmk**	31.5
122	**122Tmk**	31.5	166	**166Tmk**	37.0
123	**123Tmk**	42.5	167	**167Tmk**	26.5

124	**124Tmk**	31.5	168	**168Tmk**	26.5
125	**125Tmk**	16.0	169	**169Tmk**	31.5
126	**126Tmk**	26.5	170	**170Tmk**	26.5
127	**127Tmk**	31.5	171	**171Tmk**	26.5
128	**128Tmk**	47.5	172	**172Tmk**	26.5
129	**129Tmk**	31.5	173	**173Tmk**	37.0
130	**130Tmk**	32.0	174	**174Tmk**	10.5

Lab. No	**Sample No.**	**Iodine in mg/kg**	**Lab. No**	**Sample No.**	**Iodine in mg/kg**
175	**175Tmk**	42.0	218	**218Tmk**	21.0
176	**176Tmk**	47.5	219	**219Tmk**	37.0
177	**177Tmk**	21.0	220	**220Tmk**	31.5
178	**178Tmk**	26.5	221	**221Tmk**	21.0
179	**179Tmk**	26.5	222	**222Tmk**	31.5
180	**180Tmk**	21.0	223	**223Tmk**	21.0
181	**181Tmk**	21.0	224	**224Tmk**	21.0
182	**182Tmk**	16.0	225	**225Tmk**	10.5
183	**183Tmk**	21.0	226	**226Tmk**	21.0
184	**184Tmk**	16.0	227	**227Tmk**	47.5
185	**185Tmk**	31.5	228	**228Tmk**	26.5
186	**186Tmk**	31.5	229	**229Tmk**	58.0
187	**187Tmk**	31.5	230	**230Tmk**	21.0
188	**188Tmk**	10.5	231	**231Tmk**	63.5
189	**189Tmk**	21.0	232	**232Tmk**	32.0
190	**190Tmk**	37.0	233	**233Tmk**	32.0
191	**191Tmk**	16.0	234	**234Tmk**	31.5
192	**192Tmk**	26.5	235	**235Tmk**	21.0
193	**193Tmk**	37.0	236	**236Tmk**	31.5

194	**194Tmk**	37.0
195	**195Tmk**	21.0
196	**196Tmk**	21.0
197	**197Tmk**	21.0
198	**198Tmk**	31.5
199	**199Tmk**	42.0
200	**200Tmk**	69.0
201	**201Tmk**	26.5
202	**202Tmk**	26.5
203	**203Tmk**	26.5
204	**204Tmk**	21.0
205	**205Tmk**	63.0
206	**206Tmk**	26.5
207	**207Tmk**	21.0
208	**208Tmk**	16.0
209	**209Tmk**	21.0
210	**210Tmk**	21.0
211	**211Tmk**	26.5
212	**212Tmk**	21.0
213	**213Tmk**	31.5
214	**214Tmk**	16.0
215	**215Tmk**	26.5
216	**216Tmk**	31.5
217	**217Tmk**	31.5
Lab. No	**Sample No.**	**Iodine in mg/kg**
261	**261Tmk**	26.5
262	**262Tmk**	37.0
263	**263Tmk**	47.5

237	**237Tmk**	21.0
238	**238Tmk**	26.5
239	**239Tmk**	26.5
240	**240Tmk**	21.0
241	**241Tmk**	37.0
242	**242Tmk**	31.5
243	**243Tmk**	37.0
244	**244Tmk**	47.5
245	**245Tmk**	47.5
246	**246Tmk**	0.0
247	**247Tmk**	31.5
248	**248Tmk**	37.0
249	**249Tmk**	53.0
250	**250Tmk**	21.0
251	**251Tmk**	21.0
252	**252Tmk**	37.0
253	**253Tmk**	21.0
254	**254Tmk**	37.0
255	**255Tmk**	21.0
256	**256Tmk**	31.5
257	**257Tmk**	42.5
258	**258Tmk**	32.0
259	**259Tmk**	37.0
260	**260Tmk**	0.0

264	**264Tmk**	26.5
265	**265Tmk**	37.0
266	**266Tmk**	31.5
267	**267Tmk**	26.5
268	**268Tmk**	85.0
269	**269Tmk**	47.5
270	**270Tmk**	26.5
271	**271Tmk**	47.5
272	**272Tmk**	5.5
273	**273Tmk**	5.5
274	**274Tmk**	21.0
275	**275Tmk**	0.0
276	**276Tmk**	0.0
277	**277Tmk**	26.5
278	**278Tmk**	37.0
279	**279Tmk**	42.5
280	**280Tmk**	21.0
281	**281Tmk**	42.5
282	**282Tmk**	47.5
283	**283Tmk**	26.5
284	**284Tmk**	37.0
285	**285Tmk**	37.0

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