RISK FACTORS FOR NON-COMMUNICABLE DISEASE AMONG THE ADULT POPULATION IN THE KASSENA-NANKANA DISTRICT. A COMMUNITY-BASED SURVEY.

by

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This dissertation is submitted to the School of Public Health, University of Ghana, Legon in partial fulfillment of the requirement for the award of Master of Public Health Degree

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I declare that this dissertation was produced from data collected by myself with the help of field workers and researchers of the Navrongo Health Research Center. This work not been presented for a degree in any other university or institution.

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DEDICATION

For my dear husband,

Professor Kojo Anzah Mensa-Wilmot

. . . for the sacrifices you made.

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May the Lord Richly Bless You All !

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LIST OF ACRONYMS

5POW	Five Year Program of Work
BH	Body Height
BMI	Body Mass Index
BW	Body Weight
CVD	Cardiovascular disease
DBP	Diastolic Blood Pressure
DHMT	District Health Management Team
GAR	Greater Accra Region
HC	Hip Circumference
HDL	High Density Lipoprotein
IPAQ	International Physical Activity Questionnaire
KBTH	Korlebu Teaching Hospital
KND	Kassena-Nankana District
LDL	Low Density Lipoprotein
NCD	Non-communicable disease
NDSS	Navrongo Demographic Surveillance System
NHRC	Navrongo Health Research Center
NIDDM	Non-Insulin Dependent Diabetes Mellitus
SBP	Systolic Blood Pressure
UER	Upper East Region
WC	Waist Circumference
WHO	World Health Organization
WHpR	Waist-Hip ratio
WC	Water closet/ Flush toilet

ABSTRACT

A community-based survey of 2018 adults in the Kassena-Nankana District of the Upper East Region aged 15-64 years was carried out to assess the prevalence of certain risk factors of the non-communicable diseases; cardiovascular disease, diabetes, respiratory conditions and cancers. This survey was conducted in the month of June during the planting season for the major crops cultivated in the Kassena Nankana district.

Tobacco use among the study population was determined to be 20.9%. Men mostly smoked cigarettes and hand rolled tobacco, generally initiating this practice between the ages of 15-30years. The women mostly chewed tobacco leaves and rubbed tobacco powder on their gums; a habit initiated generally after 35years of age. Alcohol consumption was relatively high among the study population (55.03%) and was prevalent between both sexes. Shea fruits were the only local fruits that were frequently consumed. Other local fruits were consumed by less than 15% of the population surveyed.

The study population was physically active with 90% of the population engaging in daily vigorous physical exercise for at least an hour.

The prevalence of obesity was evaluated using two indices; body mass index (BMI) and waist-hip ratio (WHpR). Evaluating the study population BMIs indicated an obesity level of 2.69% whilst a higher figure of 33.9% indicative of high central obesity was derived by the computation of the WHpR.

A hypertension prevalence of 6.21% and 4.54% was found in the in the study population using systolic and diastolic cutoffs of 140mmHg and 90mmHg respectively. A more detailed study that will evaluate serum cholesterol levels and determine the prevalence of undiagnosed diabetes in the community is needed as its outcome would compliment these findings.

CHAPTER ONE

INTRODUCTION

1.1 The burden of noncommunicable disease

In sub Saharan Africa, communicable diseases still predominate[1] but there is limited evidence that suggests that noncommunicable diseases (NCDs) already present a substantial burden[2]. The burden of NCDs projected for these developing countries from the current trends in the global pattern indicates an increase from 27% to 43% from 1990 to 2020 (WHO, Evidence Information and Policy, 2000). It has been calculated that in the year 2001 chronic diseases contributed approximately 60% of the 56.5 million total reported deaths worldwide and approximately 46% of the global disease burden[3]. In Ghana, the major NCDs of public health concern are cardiovascular diseases, hypertension, diabetes mellitus, cancers, asthma and sickle cell disease. Data from studies conducted among the rural and or urban communities in Ghana on the burden of these diseases are scanty and where available, data are not representative. Outpatient statistics though available have inherent biases that must be considered when conclusions are being drawn from such data. These include completeness, coverage, variation in case definitions, accessibility to health facilities and treatment seeking patterns of the particular population. The distribution of health care facilities in this country is not uniform across various socio-demographic groups and the three northern regions have a higher burden of adult mortality and lower access to healthcare[4] than the other seven regions. It is also necessary to take into account the fact that proportional statistics is limited by the fact that it depends on the magnitude of other reported conditions.

Nationally in the year 2000 hypertension was ranked as the 9th leading cause of hospital outpatient department (OPD) visits. Though it has held this ranking since 1985, the percentage of OPD visits has risen steadily from 1.23% to 2.01% over the said period[5]. Fourteen to eighteen percent of the total OPD attendance in over 45 year old patients in the Greater Accra Region (GAR) was due to hypertension and age-specific distribution data ranked hypertension as 2nd to malaria among the top ten leading causes of OPD visits for both sexes in this group. Similar trends have been observed in the Upper East Region (UER) where 2-3% of OPD attendance for patients over 45 years was due to hypertension in the year 2000. Hypertension was ranked 7th in the same year among the list of top ten diseases causing morbidity. Analyses of cause-specific mortality data from the Navrongo Demographic Surveillance System[6] (NDSS) site in 1995, shows that mortality associated with non-communicable disease was 8% as compared to 63% due to communicable diseases, maternal, perinatal and nutritional causes in the Kassena Nankana district[7]. This database reported from age-specific data collated over the period 1995-1999, strokes and hypertension as the predominant causes of death for both sexes after the age of 45 years[4].

Respiratory diseases were ranked 4th in the list of top ten diseases over the period 2001 to 2002[7]. Earlier studies conducted on smokers in some Ghanaian communities indicated that 20% of civil servants smoked whilst prevalence in the general population was 15.1% with no significant difference due to income earned[8]. National figures for smoking-related mortality in 45+ year olds are 219 and 84/ 100,000population for males and females respectively[9]. Diseases included in this measure were trachea, lung, bronchus, lip, oral cavity and pharynx cancers.

Common cancers in Ghana include cancers of the cervix, breast, liver, lymphomas and leukemias. A community-based screening of 712 women aged 20-80 years from the Western and Upper East regions from April 1996 till August 1997 revealed that 277 (39%) who had some breast abnormality, including 13 (2%) had clinically obvious cancers[10]. Data collected from the radiotherapy unit at the Korlebu Teaching Hospital (KBTH) indicates a steady increase in patients for breast cancers and cervical cancers from 1999 through 2002. Figures for breast cancer rose from 74 in the year 1999 to 166 in 2002 whilst those for cervical cancer increased from 136 to 189 respectively.

Reported cases of diabetes mellitus in the country are also on the increase. In the earliest hospital outpatient survey at the KBTH in 1958 reported a prevalence of 0.4%, a figure that has remained the same 20 years later[11]. Reported cases were about 50% higher in females than in males. Diabetes accounted for 6.4% of all medical admissions at the KBTH between January 1986 and January 1987 compared to 3.5% a decade earlier[12]. A survey of male community members aged >15 years in 1964 showed a 0.2% prevalence of diabetes[13].

1.2 Justification

The potential harm to health of non-communicable diseases has been overlooked for several years and even when acknowledged, it has been viewed to be valid only among the affluent in society. However there are several indications to show that this is not true and that the burden of noncommunicable disease in developing countries is significant. The major non-communicable diseases are also chronic and incurable, and thus potentially could represent an enormous personal healthcare cost and economic burden.

In the 5POW 2002-2006 the Ministry of Health outlined as part of its key areas of intervention, steps to improve the access of people with chronic illnesses to healthcare by the review and establishment of exemption policies. However data on the prevalence of chronic illnesses is essential for the creation of realistic and effective policy. As new health care strategies compete for limited funding, financial and economic analyses are used to make informed choices for healthcare focus.

NCDs are largely preventable therefore appropriate assessment and management of risk factors is profitable in the long term by reducing morbidity and mortality and also by improving health outcomes in individuals at risk. Therefore an improved understanding of the influence of risk factors and their determinants is essential.

The World Health Report 2002 has identified the risk factors that are most important for predicting future disease burden. These factors share common characteristics that include: having the greatest impact on health and illness from disease or injury; the ability to be modified through effective primary prevention; the use of measurement protocols that have been validated; and that do not violate ethical principles.

A cross-sectional and community-based study assessing the public health importance of risk factors of noncommunicable disease in the Kassena Nankana district that would provide justification for the commitment of resources for the planning of effective and perhaps more capital intensive control strategies such as disease surveillance in this and other districts is proposed.

1.3 Hypothesis

Non-communicable diseases could still be a public health problem in the rural communities of Northern Ghana despite the high level of communicable diseases that is prevailing.

1.4 Objectives

The goal of this study was to describe the prevalence of risk factors of certain non-communicable diseases (NCDs) among the population aged 15-64 years in Kassena-Nankana District (KND). The specific objectives include;

1.4.1 Specific objectives

(1) To estimate the prevalence rate of some preventable, behaviour-related risk factors for noncommunicable diseases in the district.

(2) To assess health and nutrition status using selected anthropometric indices.

(3) To document the prevalence of elevated blood pressure; an intermediate biological outcome of NCD*.

*Blood samples were collected from 378 respondents to determine their lipid profile but data are not included in this text.

1.4 Definition of variables

- Adult population in this study made reference to the section of the population that was economically productive; age group 15-64 years.
- Hypertension : Systolic blood pressure $\geq$ 140 mmHg and/ or diastolic blood pressure $\geq$ 90 mmHg, or self-reported current use of anti-hypertensive medication.
- Obesity : a Body Mass Index (BMI) of $\geq$ 30 kg/m^2.
- Central obesity : Waist/Hip ratio of > 0.85 for women and >0.90 for men or being in the upper quartile of their sex-specific distribution.
- Overweight : BMI > 25 kg/m^2
- Normal weight : BMI 18.5-25 kg/m^2
- Underweight : BMI of < 18.5 kg/m^2.
- Physical activity : Individuals who spent greater than half the day on their feet or were involved in daily moderate to vigorous activity were defined as physically active. Individuals who spent less than half the day on their feet or who led a sedentary lifestyle were classified as physically inactive.
- Tobacco intake : smoking, chewing and ingestion of tobacco or tobacco-containing products.

CHAPTER TWO

LITERATURE REVIEW

The overall goal of the WHO Global Strategy on Diet, Physical Activity and Health which was developed at the request of the Director-General in May 2002, in consultation with member states and the UN system, is to guide action which would lead to reduced disease and death rates due to chronic diseases in all populations[14]. For all countries the underlying broader determinants of NCDs include urbanization, globalization, increased marketing, consumption of tobacco and displacement of nutrient rich foods such as fruits, vegetables and legumes and their replacement by foods high in fats and /or sugar and low in micronutrients, and reduced levels of physical activity.

A profound shift in the major causes of death and disease pattern is under way in most countries. Of even greater concern are the effects of rapid nutrition transition and the increase in the prevalence of risk factors for non communicable disease such as physical inactivity, smoking, alcohol consumption and overnutrition in the developing world where there are accelerating rates of cardiovascular diseases and cancers, as well of obesity and type II diabetes.

2.1 Risk factors common to major non-communicable diseases

Risk factors are defined as any attribute, characteristic or exposure of an individual, which increases the likelihood of developing a disease or injury. The term is used to describe features of lifestyle and behavior, as well as physical and biochemical attributes that predict an increased likelihood of developing a disease. Risk factors for NCDs include genetic, behavioural, biological and environmental factors as well as

combinations of these interacting with one another. With the exception of susceptibility due to age, sex and genetic makeup, the knowledge of risk factors may serve as basis for disease control. Examples of these are behavioural factors (diet, physical inactivity, tobacco use, alcohol consumption); biological factors (hyperinsulinaemia, overweight, dyslipidemia, hypertension); and social factors which include a complex mixture of interacting socioeconomic, cultural and other environmental parameters.

2.1.1 Risk factors of NCDs; a tool for primary prevention

Risk factors of disease can be influenced to change health outcomes[15]. For example the majority of the 32 million individuals who develop heart attacks and strokes every year have one or more cardiovascular disease risk factor: obesity, hypertension, diabetes, tobacco use, high serum lipids or physical inactivity[16]. Most of these CVD events are preventable if meaningful action is taken against risk factors. Too frequently the focus is on treatment of a single risk factor in isolation rather than on the basis of a comprehensive CVD risk management program since diseases often have multiple causes.

Treatment of established disease will always have a role in public health practice, especially in the instances of diseases such as tuberculosis where treatment contributes to prevention[18], but it has been shown that a few risk factors of disease account for a large contribution to global loss of healthy life.

The major risk factors for these non-communicable diseases that have major impact on health and are not amenable to intervention have been documented worldwide. The identification and measurement of the prevalence of risk factors of non-

communicable diseases in a particular community should be the basis of any effective program. This is because primary prevention is the most cost-effective approach especially in developing countries where health services are overstretched and inaccessible to many.

2.1.2 Genetic factors

Although host factors other than genes may play a role in the development of a non-communicable disease such as cancer, some of these factors are increasingly being recognized to be under genetic control. The potential role of genetics should not however be overstated since for example only about 5% of all breast cancers occur in women with a genetic predisposition to the disease[18]. It is known that cancer is initiated by various degrees of interaction between genetic factors of the host and exogenous factors such as carcinogens.

2.1.3 Nutrition

Diet exerts its greatest influence on disease by modifying these factors[19]. A high fat diet cannot initiate cancer but may cause the body to secrete certain hormones that create a favorable environment for development of certain cancers; it may also promote the secretion of bile into the intestine where organisms may convert the bile into compounds that cause cancer. The consumption of fiber might help to protect against some cancers by hastening the excretion of bile from the body or by speeding up the transit time of all materials through the colon so the colon walls are not exposed for long to potential carcinogens in the gut.

2.1.4 Alcohol

Besides the toxicity of excessive alcohol intake and the tendency to become dependent on alcohol, there is also the possibility of long term damage to the nervous system, liver and other organs[18]. The effect of alcohol on cardiovascular disease is a highly controversial issue. There is a considerable body of evidence to suggest that a modest intake of alcohol, especially red wine has a protective effect against coronary heart disease, perhaps via a beneficial effect on HDL cholesterol, fibrinogen and platelet activity, and or because of the presence of antioxidants. However the sharp increase in mortality associated with more than two drinks/ day suggests that public health recommendations that emphasized the positive health effects of alcohol would be likely to do more harm than good. Alcohol plays several roles with respect to the development of heart disease. Research suggests that moderate alcohol consumption raises HDL cholesterol and therefore reduces the risk of heart disease[21], however consumption in high doses is associated with hypertension and cancer of the oral cavity, pharynx, larynx, oesophagus, liver and breast. The carcinogenic effect of alcohol is exacerbated by tobacco use. While the relation between alcohol and cancer is nearly linear between volume drunk and risk, that of tobacco and cancer is different; where any degree of exposure; passive or active is hazardous[18].

2.1.5 Tobacco products

Different modes of addictions to tobacco products; smoking and tobacco chewing have equal and comparable adverse effects on lipid profile and therefore raising cardiovascular risk in same proportion[21]. Laboratory clinical and epidemiological studies have

demonstrated that tobacco in all its forms greatly increases the risk of premature death from chronic diseases, among them coronary heart disease, stroke, chronic bronchitis and emphysema and cancers of the lung, pharynx, mouth, oesophagus, pancreas and bladder. Tobacco use is also a contributing factor to cancers of the cervix and kidney. The exposure to environmental tobacco smoke is also a cause of lung cancer among non-smokers. Tobacco affects health in many ways; through nicotine, tar and the effect of carbon monoxide in the smoke on body function.

2.1.6 Physical inactivity

Moderate activities such as walking for an hour a day is required to maintain normal body weight especially in sedentary people. Kim and others (2001)[22] found that exercise frequency might be more important than intensity for favorably influencing cholesterol levels. This confirmed findings of a cross-sectional study among a Japanese population that revealed that high HDL cholesterol levels were associated with higher frequencies of physical activity[23].

2.1.5 Obesity

Anthropometry is the measure of the variations of physical dimensions and gross composition of the human body at different age levels and degrees of nutrition. Body fat and fat-free mass; the two major components of total body mass may be measured using anthropometric indices such as the weight/height ratio. Since obesity indices cannot be used to differentiate between excessive weight produced by adiposity, muscularity or oedema, a more direct measure such as skin fold thickness is employed when practical.

Upper body or central obesity as measured by the waist/hip ratio (WHpR) is another measure for measuring more precisely (than skin folds) the distribution of sub-cutaneous and intra-abdominal adipose tissue[24]. Risk of morbidity or mortality from ischemic heart disease is however proportional to the size of the WHpR independent of gender[25]. The body mass index (BMI) or Quetelet's index is considered the gold standard for adult populations. This is because in adults it correlates with many factors of mortality risk. However due to the confounding of diet, smoking and levels of physical activity the range of acceptable BMIs may vary amongst communities. It has widely been concluded that the relationship between BMI and mortality is U-shaped or J-shaped. The causes of death at the extremes of the curve are strikingly different; high mortality at low BMI is dominated by digestive and pulmonary (respiratory) diseases, but at high BMI it is related predominantly to cardiovascular disease, diabetes mellitus and gall bladder disease[26]. It is sometimes argued that the high mortality at low BMI is due to the confounding presence of smoking. BMI is also an important predictor of all three lipid measures (triglycerides, HDL and LDL cholesterol) and diastolic blood pressure (DBP). Chief co-morbidities associated with overweight and obesity include CVD, cancers of the breast, endometrium, prostate and colon; non-insulin dependent diabetes mellitus (NIDDM) and gall bladder disease. The patterns of increasing relative risk for subsequent mortality with increasing overweight as indicated by BMI has been observed[25].

2.1.6 Raised Blood Pressure

Increasing levels of systolic and diastolic blood pressure $\geq$ 140 mm Hg and $\geq$ 90 mm Hg respectively are associated with increased rates of coronary heart disease (CHD) and

stroke (cerebral vascular disease). Major factors that are associated with hypertension are genetic makeup, body weight, alcohol and salt intake. Achieving optimal body weight, taking regular exercise, cessation of tobacco and excessive alcohol use are general health measures likely to reduce blood pressure levels in populations prone to hypertension as well as reducing elevated blood pressure levels in those who have already established disease.

2.1.7 Dietary fat/ blood lipids

Blood lipids have been established as fundamental to artherosclerosis and there is a better understanding of the process and of various pharmacologic agents to counter the mechanisms involved[28]. Altered levels of blood lipids found in lipoproteins may place individuals at an increased risk of coronary heart disease in three ways.

- A relatively small proportion of people have an exceptionally high risk because of clearly inherited increase in plasma lipids.
- A large number of people have a slight to moderately increased risk because their blood lipids are higher than desirable as a result of an interaction between polygenic and lifestyle-related factors.
- Some people are at increased coronary heart disease (CHD) risk because of low levels of high-density lipoprotein (HDL).

The ratios of total cholesterol (TC) /HDL cholesterol, LDL cholesterol /HDL cholesterol are amongst the best measures of CHD risk. Elevated levels of LDL/HDL cholesterol have been used to better express risk, balancing the opposing effects of LDL cholesterol

and HDL cholesterol on CHD, whereas TC /HDL cholesterol ratio takes very low LDL into account[20].

2.1.8 Challenges of Noncommunicable disease Management

Health care systems in developing countries are ill-prepared to provide services needed to prevent and manage NCD. There is no clear strategy for delivering the needed services in the context of limited resources. A broad public health approach that takes into account the many social and economic factors that affect populations and influence the major established risk factors is therefore needed. Although global and national NCD surveillance ranks low in the public health priorities, surveillance for both diseases and risk factors that predict them is essential to monitor the evolution of the disease burden and to evaluate the effects of prevention and control policy[27].

Research has shown clearly a relationship between health and socioeconomic status especially among the poorest in a population. This segment of the population is at an increased social disadvantage in terms of the incidence of chronic diseases as well as access to treatment. In a rural setting such as Kassena-Nankana district health policies need to be appropriately targeted, unambiguous and educative in order to be effective.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

This was a community-based cross-sectional survey in which a sample representative of the district population was surveyed. Survey questionnaire developed was based on the WHO Stepwise Approach[29] and IPAQ[30] (International Physical Activity Questionnaire) guidelines and protocols.

3.2 Study Site Profile

This community-based survey was conducted in Kassena-Nankana District (KND), one of the six districts in the in the Upper East Region of Ghana. The district stretches over an area of 1,674 km^2 along the Ghana-Burkina Faso border and is home to a population of 141,477 inhabitants according to the Navrongo Demographic Surveillance System[6] (NDSS). The district houses the Navrongo Health Research Center (NHRC) which amongst other research endeavors, employs the NDSS, a sophisticated surveillance system to map the population of the entire district, monitoring and updating the population dynamics every 90 days. The NDSS therefore provides an effective sampling frame for identifying target populations for conducting research projects in the district.

Kassena-Nankana district is home largely to a rural population. According to the district profile (Annual Report of the DHMT, 2001) only 13% of the population is urban and majority of the residents are subsistent farmers. Petty trading and animal husbandry were named as common activities.

3.3 Study Population

The study population selected was composed of respondents living in the Kassena-Nankana District aged between 15-64 years. For the purposes of this study this population was referred to as an adult population because in the Kassena Nankana District this age group represented the economically active populace.

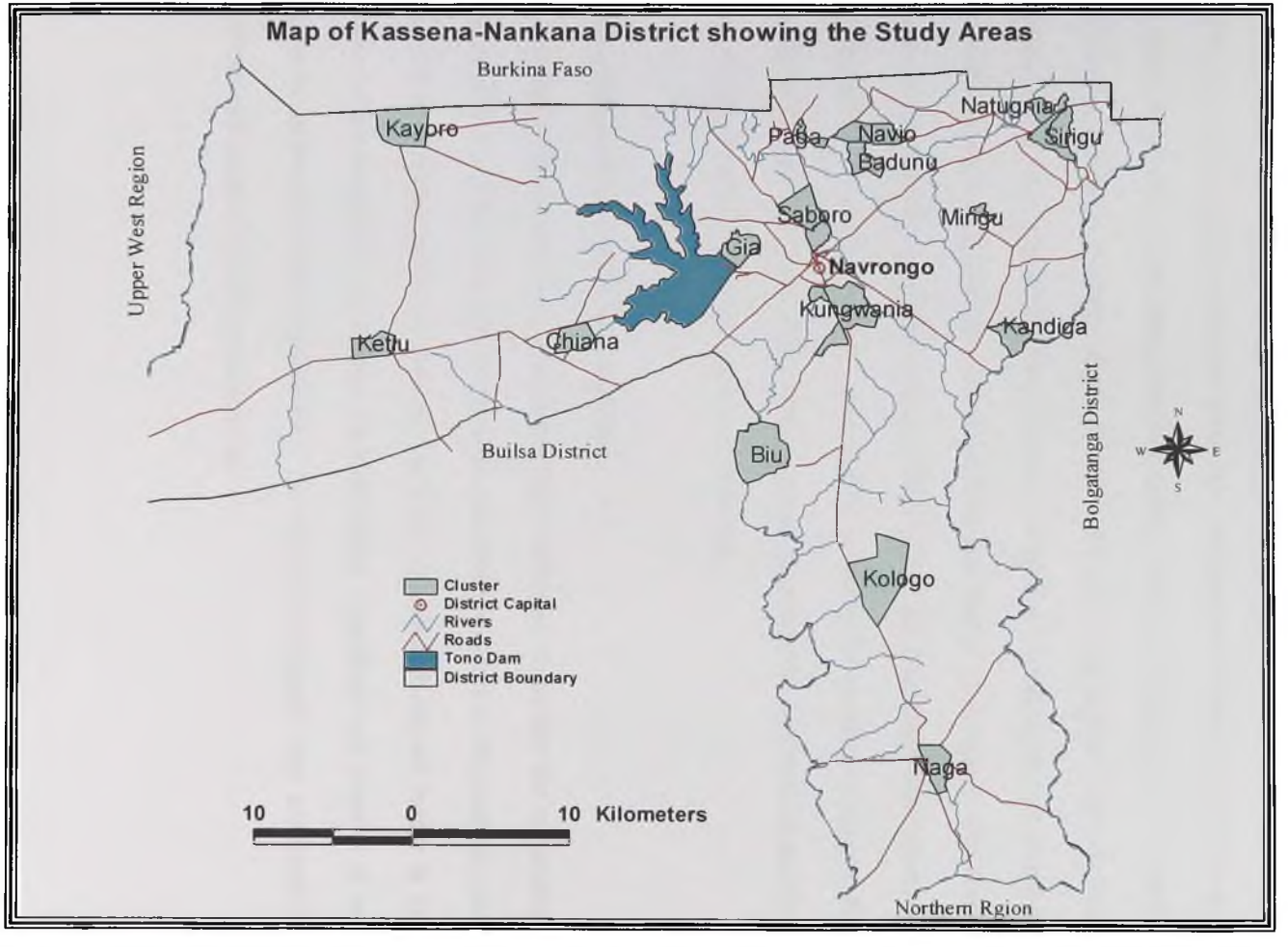
3.4 Sample size

A total of 2171 residents in the Kassena-Nankana District were involved in this study. Since prevalence of these risk factors has not been documented in this district or nationally, this number was derived from similar research in other countries with modification. An approximate sample size of 1600-2000 adults is recommended[29] to be sufficient to allow the detection of trends in risk factor prevalence by sex and age overtime if this baseline study were to be repeated. However since Kassena-Nankana district is likely to have very low prevalence of obesity and hypertension; the upper limit was the target sample size for this study. A sub-sample of the respondents was asked to give blood samples for serum lipid profile analyses to be performed.

3.5 Sampling Technique

Simple random sampling of participants from the entire district would have been ideal but this was not deemed feasible because it would entail more traveling to locate potential participants, involving a cost that would have been beyond the budget for this study. It would also have been unacceptable to invite only one or two people from one compound to participate in the study without asking other eligible compound members.

In the Navrongo Demographic Surveillance Systems database the district is divided into five zones (North, South, West, East and Central) within which there are a total of 21 sub zones (and within these sub zones, 14,500 compounds). A multi-stage sampling technique was used to select the study population. The sampling frame included all the 14,500 compounds in the entire district. By the proportion of the compounds in each zone, a total of 22 index compounds were randomly chosen (Fig. 1 shows a distribution of the chosen study sites). Given an estimate of six eligible adults per compound, about 20 compounds were mapped around each index compound. This allowed for a total of about 2000 respondents to be drawn to participate (with anticipation for refusals). The list of all residents of the index compound and its surrounding compounds was generated from the Navrongo Demographic Surveillance System database for each site that was visited. By systematic sampling with a random start, a sub-sample was selected from the list of potential respondents from whom a blood sample was requested during the interaction.



3.6 Data Collection Procedures

3.6.1 Training & standardization of data collection tools & protocols

The questionnaire was translated into Kassem and Nankam and then back translated into English during the training sessions to ensure that the translation into the local language was uniform and did not alter the questions communicated to the respondents. Training involved role-playing to ensure standardized techniques. Ambiguities and incorrect translations were resolved during these sessions. Guidelines for physical measurements were communicated to ensure the use of uniform and correct techniques. The blood samples were drawn by qualified nursing officers from the Navrongo War Memorial Hospital, KND. A pilot trial was conducted in a nearby community to observe the protocols and equipment being used and to give an opportunity for modification and fine tuning of the procedures before the actual survey began.

3.6.2 Community entry procedures

The necessary community entry procedures were performed to inform the community about the survey and to seek consent prior to the commencement of the study in each area. On a pre-arranged day, a meeting was held with each traditional leader in the presence of the community to explain the justification, objectives and protocol of the study to be undertaken in their community. Concerns of the people were addressed in this forum and questions posed were answered.

3.6.3 Ethics procedures

3.6.3.1 Ethical review by NHRC Institutional Review Board (IRB)

The study protocol was reviewed by the Navrongo Health Research Centre Institutional Review Board (NHRC-IRB) for ethics violations following an examination of the study proposal by an NHRC Adhoc Scientific Review Committee. The IRB granted approval for the study to be carried out on April 12th, 2003 (see document in Appendix 1) with recommendations.

3.6.3.2 Informed consent

Informed consent was obtained from respondents in the desired age-bracket who volunteered to participate in the study. The study objectives and protocol were explained to every potential respondent (see consent form in Appendix 2). Individuals were then given the opportunity to ask questions and seek clarification on the information they had been given. Interested individuals were then registered and a signature was obtained as proof of their consent. Individuals who had been preselected to donate a blood sample for lipid profile analyses were then informed and given the option to accept or to decline. A signed copy of the consent form was given to each respondent.

3.6.3.3 Ethical considerations

When blood pressure measurements were indicative of hypertension, the respondent was advised, given a short term supply of the medication if necessary and referred to the nearest health center for further treatment. Qualified medical personnel were on hand to consult with hypertensive respondents. Data and samples collected will be used only for

purposes of the study. All data and samples collected will be analyzed and reported only for the purpose of quantifying the prevalence on NCD and in the interpretation of the implications thereof.

3.6.4 Behaviour survey

A total of 22 study sites were visited (Table 1) and a maximum of one hundred and twenty five questionnaires were filled at each location. After obtaining a signature indicating consent from a potential respondent, a questionnaire was administered in English, Kassem or Nankam. The relevant demographic and socio-economic data were obtained. Questions were asked to estimate the frequency of tobacco use, alcohol consumption, physical activity and fiber-rich diet.

3.6.5 Physical measurements

3.6.5.1 Blood pressure

Blood pressure as an indicator of hypertension, and pulse rate measurements were taken of the respondents after a 5-minute rest in a seated position. These measurements were made with an electronic validated device (Omron R5-I Wrist Digital Blood Pressure Monitor, West Essex, United Kingdom) and recorded in triplicate. The mean of the second and third readings taken at least 5 minutes apart were analyzed.

3.6.5.2 Weight

A portable electronic scale was used to measure body weight (BW) of the respondents with an accuracy of $\pm$ 0.1kg. Subjects were all weighed without shoes.

3.6.5.3 Height

Standing body height (BH) was measured without shoes to the nearest 0.1cm with a commercial stadiometer with respondents' shoulders in a relaxed position and arms hanging freely.

Body Mass Index (BMI) an indicator of body fat was calculated as BW in kilograms (kg) divided by the square of the BH in meters (m^2).

Table 1. Selected study sites and index compounds that were visited

TEAMS	*DATE*	*LOCATIONS*	*INDEX COMPOUNDS*
I	12th June	**Kugwania**	***SAJ59***
2		**Kugwania**	***SAK33***
1	13th June	**Kayoro**	***WGB66***
2		**Naga**	***SJC18***
1	14th June	**Chania**	***WCE05***
2		**Kandiga (East)**	***SDG41***
1	16th June	**Kologo**	***SHA57***
2		**Katiu**	***WAA13***
1	17th June	**Navio**	***NDA28***
2		**Natugnia**	***EEB29***
1	18th June	**Sirigu**	***EEE09***
2		**Sirigu**	***EEC11***
1	19th June	**Paga**	***NDC38***
1	20th June	**Paga**	***NAA38***
2		**Mirigu**	***EBE44***
1	21st June	**Saboro (central)**	***WFE05***
2		**Saboro (central)**	***WFF69***
1	23rd June	**Biu**	***SGK17***
2		**Vunania**	***SAB14***
1	24th June	**Nagalkinia**	***SGT14***
2		**Nogsinia**	***CAM95***
2	25th June	**Gia**	***WEB46***

3.6.5.4 Waist and Hip Circumference

Waist circumference (WC) was measured in the middle between the 12th rib and the iliac crest at the level of the umbilicus and the hip circumference (HC) at the fullest point of the buttocks. WC (cm) was divided by HC (cm) to obtain the waist-hip ratio (WHpR) a measure of central or upper body obesity or the position of adipose tissue around the abdomen. Means of replicates were reported in all anthropometric measurement.

3.7 Data Management

The filled questionnaires were examined to exclude incomplete forms. A screen was then created to allow data from the questionnaire to be entered into files in the program FOXPRO (Fox Software Inc., OH, USA). This screen was inbuilt with checks to minimize errors. Another mechanism used to minimize errors introduced during data entry was the process of double entry. This is a process of creating two identical data files by entering the same data twice and then merging them. The process of superimposition reveals any inconsistencies that exist.

3.8 Statistical Analyses

Data files were converted into STATA (Stata Corporation, Texas,USA) to facilitate tabulation and statistical manipulation. Where appropriate, results are presented as means $\pm$ standard deviation of the mean. Findings are presented as proportions of the total study population. Age- and gender specific rates are also shown. The prevalence of risk factors is given as percentages, and the χ^2 test that tests for linear association is used to determine the significance of trends in age among both males and females ($p<0.05$).

The odds ratios were determined to evaluate any differences between the prevalence of risk factors of non-communicable disease among the different sexes.

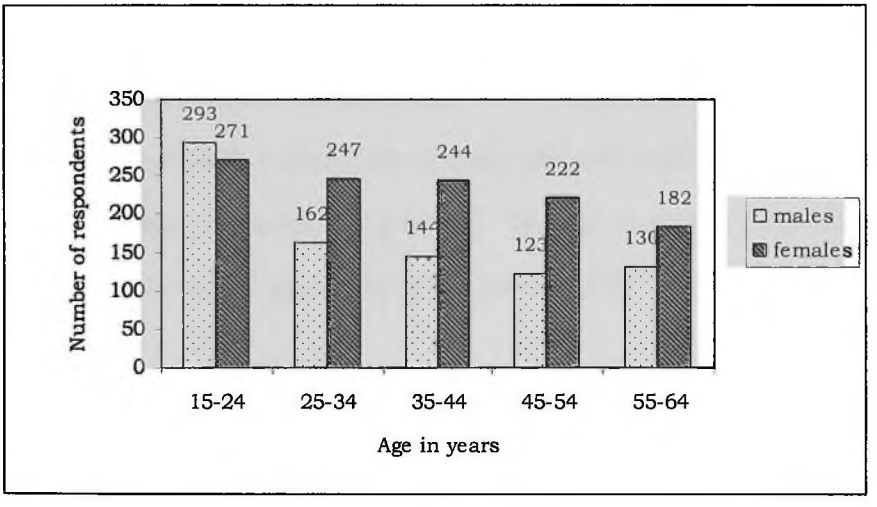
CHAPTER FOUR

RESULTS

4.1 Demographic and Socio-economic characteristics

Data from two thousand and eighteen (2018) questionnaires were included in the analyses. One hundred and fifty seven questionnaires were omitted due to incomplete answers. The mean age of the entire study population was 36.0 ± 14.6 years with a median age of 35 years. That of the male respondents was 35.0 ± 15.1 years and for the female respondents; 37.8 ± 14.2 years. The median ages for males and females in the study population were 33 and 37 years respectively. The distribution of age and sex is shown in Fig. 2.

Figure 2. The distribution of the study population by age and sex



In the study population 67.5% of the respondents (aged 15-64 years) were <45 years of age. A quarter (24.9%) of the study population had never been married as of the time of the interaction (data not shown).

4.1.1 Education

Among the study population, women were disadvantaged. This is indicated by the fact that the ratio of women to men who had had no formal education was 2:1 (Table 2). The literacy rate in the district was low; 51.8% of the population sampled had had no formal education. Twenty five percent of the respondents had only primary level education and about 1% had post-secondary education or tertiary level qualification. Among those respondents who had had primary and secondary education, the proportion of male to females was almost the same.

4.1.2 Employment

About a fifth (21.63%) of the study population was unemployed at the time of the interaction; half of these were aged between 15-24 years of age. Fifty three percent (53.51%) of the study population are farmers by profession and about thirteen percent are traders (13.69%); mostly women (Table 2). Employment in the service industry (including hairdressers, hoteliers, bar operators etc.) and employment in the production industry (mostly blacksmiths) accounted for the remaining respondents. An unemployment rate of about twenty-two percent (21.7%) was found in the study population.

An attempt was made to describe the socio-economic status of the study population by gathering information on their education and employment status, nature of dwellings and the basic amenities available to them such as potable water and electricity. Selected possessions such as bicycles and radios were enumerated as an indicator of their wealth.

4.1.3 Dwellings

Almost half (48.3%) of the respondents had a roof that had been constructed by plastering earth and cow dung over a supporting structure made of sticks (data not shown). A portion of this material has to be replaced annually during the dry season to repair the damage and eroding effect of the heavy rains. Thirty seven percent of the respondents lived in dwellings that had zinc roofing, a more durable though costly alternative to earth and dung. Majority of the dwellings (65.6%) had cement flooring whilst about a third (33.7%) had earth dung flooring. A majority (86.3%) of the dwellings was built with earth/dung walls and only a few (13.1%) were plastered or constructed with cement. The mud houses are typical of rural settlements as would be expected in a community such as Kassena-Nankana that is mostly rural.

4.1.4 Potable water

Though a largely rural community, Kassena-Nankana district had adequate potable water supply. The source of drinking water in the district is groundwater; boreholes and wells are where most respondents (53.1% and 43.5% respectively) obtain drinking water. The more affluent in society had potable water piped to their compounds whilst others had access to boreholes shared by several compounds. However, properly constructed toilet facilities were evident only in the urban community of the district. Almost 93% of the population defecated in their surroundings due to a lack of toilet facilities (Table 2).

4.1.5 Electricity

There are two sources of electricity found in the Kassena-Nankana district. They are; acquisition of a connection to the national grid or the generation of electric power by the use of solar panels. Only a tenth of the study population has electricity supplied to their homes (Table 2).

4.1.6 Possessions

Since the use of a television set and refridgerator are dependent on having an electricity supply in the home, relatively few individuals (12.9%, 5.2% respectively) in our study population possessed either gadget.

Bicycles are the most common mode of transportation in the KND among both the young and elderly of both sexes. Eighty percent (81.7%) of the study population possessed one. Almost a tenth (9.3%) of the study population owned motorcycles and a very few, the more affluent in society (3.0%) owned an automobile. Radios were a common possession but only seven individuals owned a tractor among the respondents interviewed. Animal husbandry is a common activity in the district. More than half of the study population (56.2%, 63.7%, 81.5%) reared cattle, sheep and goats respectively whilst 34.5% kept pigs (data not shown). Livestock is relied upon and put up for sale when money is needed for an emergency or to service a debt, and not usually used for the regular nourishment of the family.

Table 2. Socio-demographic characteristics of the study population

Variables	Count		Percentages		
Age/years	**Male**	**Female**	**Male**	**Female**	***Total***
15-24	293	271	14.52	13.43	27.95
25-34	162	247	8.03	12.24	20.27
35-44	144	244	7.14	12.09	19.23
45-54	123	222	6.10	11.00	17.10
55-64	130	182	6.44	9.02	15.46
Total	852	1166	42.22	57.78	100.00
Educational level					
None	340	704	16.87	34.92	51.79
Primary	260	245	12.90	12.15	25.05
Secondary	234	211	11.61	10.47	22.07
Post-Secondary	16	6	0.79	0.30	1.09
Total	850	1166	42.16	57.84	100.00
Occupation					
None	185	251	9.18	12.45	21.63
Agric. Industry	542	538	26.88	26.69	53.57
Trading Industry	26	250	1.29	12.40	13.69
Service Industry	61	52	3.03	2.58	5.61
Production	22	67	1.09	3.32	4.41
Managerial, clerical	14	8	0.69	0.40	1.09
Total	850	1166	42.16	57.84	100.00
Water Source					
Pipe	364	513	18.06	25.46	43.52
Borehole	452	617	22.43	30.62	53.05
Stream/river	33	36	1.64	1.79	3.42
Total	849	1166	42.134	57.866	100.00
Toilet Facility					
In home	3	7	0.15	0.35	0.50
Public facility	65	77	3.23	3.83	7.06
None	781	1079	38.82	53.63	92.45
Total	849	1163	42.1968	57.8032	100.00
Possessions					
Electricity	68	136	3.37	6.74	10.11
Radio	680	866	33.70	42.91	76.61
Bicycle	693	953	34.34	47.22	81.57

4.2 Risk factors for non communicable disease

Information was sought on the presence and levels of lifestyle-related risk factors such as tobacco consumption, alcohol use, level of physical inactivity, fruit consumption, obesity and hypertension.

4.2.1 Tobacco

Four hundred and twenty two respondents in the study population (20.9%) were currently using tobacco and tobacco products regularly, of whom only three of these respondents did not use these products daily (Table 3). The variety of tobacco products included various brands of imported and locally manufactured cigarettes and locally grown tobacco.

Table 3. The prevalence of tobacco use among the study population

Age/yrs	Uses tobacco (%)			Does not use tobacco (%)		
	male	female	total	male	female	total
15-24	0.50	0.10	0.59	14.02	13.33	27.35
	(10)	(2)	(12)	(283)	(269)	(552)
25-34	2.68	0.25	2.92	5.35	11.99	17.34
	(54)	(5)	(59)	(108)	(242)	(350)
35-44	4.21	1.04	5.25	2.92	11.05	13.97
	(85)	(21)	(106)	(59)	(223)	(282)
45-54	3.32	1.93	5.25	2.78	9.07	11.84
	(67)	(39)	(106)	(56)	(183)	(239)
55-64	3.96	2.92	6.89	2.48	6.10	8.57
	(80)	(59)	(139)	(50)	(123)	(173)
Total	14.67	6.24	20.91	27.55	51.54	79.09
	(296)	(126)	(422)	(556)	(1040)	(1596)

Trend for males; χ^2=226.74, p<0.00
Trend for females; χ^2=148.21, p<0.00

The modes of use included smoking, chewing on the leaves to suck the juice and rubbing a powdered form on ones gums. Some respondents indicated that they used tobacco in more than one of the forms of tobacco enumerated. Among the age groups it was observed that a greater proportion of males used tobacco products than did females (Table 3). The prevalence of tobacco use is observed to be greater with increasing age among the population sampled. There was a significant linear association between one's age and the tendency to use tobacco among both male and female population (χ^2=226.74, p<0.00, χ^2=148.21, p<0.00 respectively). It is evident from the age specific prevalence ratios were higher among older respondents. The data collected indicated that cigarettes and hand rolled tobacco were more commonly used by men. Women mainly chewed tobacco leaves or rubbed tobacco powder on their gums. Twice as many women as men smoked tobacco leaves in a pipe. Generally, men in all age groups interviewed used tobacco and tobacco products, even teenagers. However women who used tobacco were mostly over the age of 35 years. An attempt was made to estimate the age at which individuals began to use tobacco and tobacco products. Over a sixth (17.7%) of the study population who smoke cigarettes had began to smoke in their teenage years and more than half of the cigarette users had began when they were less than 30 years old. This trend observed was similar to that found in the use of hand rolled tobacco. The peak age at which women began to chew tobacco and use tobacco powder was relatively later; 40-49 years of age. About 15% of cigarette and hand rolled tobacco users could not provide us with this information. This rate more than doubled for the other tobacco products (30-40%). Mean ages at which respondents began to use tobacco are as follows: cigarettes -

26 years; hand rolled tobacco -29.7 years; chewing tobacco -38.5 years; pipe tobacco -39 years; powdered tobacco -40.2 years.

4.2.2 Alcohol

The various alcoholic beverages commonly available in KND included pito, akpeteshie, locally distilled gin, imported wines and beer. Over half (55%) of the study population had consumed alcohol at a time in their lives and some respondents currently consumed more than one kind of alcoholic beverage (Table 4); a high prevalence rate. Except for the respondents under 25 years of age among whom alcohol use was least prevalent, the proportion of males who consumed alcohol was almost or greater than 28% among the male population. For females, the proportion was mostly closer to 27%. However there was indication of a significant linear relationship between age and alcohol use among the

Table 4. The prevalence of alcohol consumption among the study population

Age/yrs	Uses alcohol (%)			Does not use alcohol (%)		
	male	female	total	male	female	total
15-24	5.21	3.07	8.28	9.32	10.36	19.68
	(105)	(62)	(167)	(188)	(209)	(397)
25-34	6.00	6.05	12.05	2.03	6.20	8.23
	(121)	(122)	(243)	(41)	(125)	(166)
35-44	5.60	5.85	11.45	1.54	6.25	7.78
	(113)	(118)	(231)	(31)	(126)	(156)
45-54	5.26	6.84	12.10	0.79	4.16	4.96
	(106)	(138)	(244)	(16)	(84)	(100)
55-64	5.90	5.26	11.16	0.55	3.77	4.31
	(119)	(106)	(225)	(11)	(76)	(87)
Total	27.96	27.07	55.03	14.23	30.74	44.97
	(564)	(546)	(1110)	(287)	(620)	(907)

Trend for males; χ^2=196.43, p<0.00
Trend for females; χ^2=93.80 p<0.00

respondent population (χ^2=196.43, p<0.00, χ^2=93.80, p<0.00 respectively). Almost half (48.7%) of the study population consumed pito, a local alcoholic beverage brewed from millet grain. Beer was consumed by 12.5% whilst 23.8% of the respondents consumed akpeteshie. Only about 1% of the respondents consumed gin and imported wines. With the exception of akpeteshie where the ratio of men to women consuming the beverage is almost 2:1, the tendency for alcoholic beverage consumption was comparable across both sexes.

An attempt to obtain an estimate of the quantity of beverage consumed at a time by an individual was not successful. Culturally, alcoholic beverage consumption is regarded as ones personal matter that is not appropriate to be discussed openly. Approximately 30% of those who consumed pito and akpeteshie and 15% of those who consumed beer declined to give responses to the question or indicated that they had no recollection on how much alcoholic beverage they consumed on occasion.

4.2.3 Fruit in diet

Using a food frequency recall respondents were asked to indicate the frequency of fruits in their diet. The list of fruits included shea fruit, mangoes, oranges, watermelons, guava, pawpaw and pineapples. Respondents were allowed to indicate more than one fruit of choice that was part of their diet. Although these fruits were mostly in season and available in various parts of the country, it was observed that they were not available in the rural communities. Some of these fruits are also available on a seasonal basis. At the time of the study, oranges and mangoes were not in season and therefore not so readily available even in the urban areas, though shea fruit and watermelons were in season.

Table 5. Frequency of fruit consumption among the study population

Fruit	Frequency of consumption		
	Never	1-2 days/week	≥ 3 days/week
	Percentage of Respondent Population		
Shea fruit	24.90	22.92	52.23
Mangoes	86.06	10.71	3.22
Oranges	95.34	3.52	1.14
Watermelons	96.38	3.17	0.45
Guava	94.56	2.84	2.59
Pawpaw	97.61	1.49	0.89
Pineapples	97.87	1.79	0.34

This period in the year, the planting season in the UER is a lean season when food stocks from the previous harvest have almost run out. Millet, maize, sorghum and cowpeas are the staples and fresh produce is scarce in the rural communities. Oranges and pineapples are not locally grown in the northern regions of the country and therefore are transported into the UER from the middle belt of the country. Sheanut trees grow wild and are abundant in the district and this was evident in the diet of the respondents (Table 5). Three quarters (75.1%) of the study population consumed shea fruits weekly and 13.9% included mangoes in their diet weekly. Fruit did not feature prominently in the diet of the study population. A limitation of the study protocol was that a total dietary recall was not performed and therefore the fruit composition of the diet could not be quantified as per serving size.

4.2.4 Physical activity

A recall over the past week was used to estimate the level of physical activity of the respondents. Individuals who engaged in vigorous activity on at least one day in a week

were said to be physically active (Table 6). In all the age groups a greater proportion of female respondents were observed to be physically inactive than for the male population.

Table 6. The prevalence of physical inactivity of the study population

Age/yrs	physically active (%)			physically inactive (%)		
	male	female	total	male	female	total
15-24	13.93	11.30	25.24	0.59	2.13	2.73
	(281)	(228)	(509)	(12)	(43)	(55)
25-34	7.44	10.51	17.95	0.59	1.74	2.33
	(150)	(212)	(362)	(12)	(35)	(47)
35-44	6.79	10.71	17.50	0.35	1.39	1.74
	(137)	(216)	(533)	(7)	(28)	(35)
45-54	5.60	9.77	15.37	0.45	1.24	1.69
	(113)	(197)	(310)	(9)	(25)	(34)
55-64	5.95	7.49	13.44	0.50	1.54	2.03
	(120)	(151)	(271)	(10)	(31)	(41)
Total	39.71	49.78	89.49	2.48	8.03	10.51
	(801)	(1004)	(1805)	(50)	(162)	(212)

Trend for males; χ^2=3.91, p<0.42
Trend for females; χ^2=4.88 p<0.30

About half of the respondents had been involved in vigorous physical activity on a daily basis while about 10% of the respondents had not been involved in any vigorous activity over the past seven days. Two percent of respondents involved in vigorous activity did so for less than 1 hour in a day. However, about 50% of the study population spent up to 6 hours a day involved in vigorous activity and a third; between 7 and 12 hours a day (data not shown). Overall, only about 10% of the study population was physically inactive. No relationship was observed between age of a respondent and the level of physical activity. This may be due to the fact that an overwhelming majority (90%) of the population was active.

4.2.5 Anthropometric measurements

- **Height and weight**

The mean height of the study population was 1.62 ± 0.09m and the median height was 1.94m. The male respondents were relatively taller than the females with a mean height of 1.67 ± 0.10m as compared to 1.58 ± 0.12m. The mean height of the males in the study population was higher in all age groups than that of the females sampled (Table 7).

Table 7. Mean height of the study population

	Mean Height ± SD (m)	
Age/years	**Male**	**Female**
15-24	1.63± 0.11 (293)	1.57± 0.13 (271)
25-34	1.71± 0.07 (162)	1.59± 0.11 (247)
35-44	1.69± 0.09 (144)	1.58± 0.16 (244)
45-54	1.68± 0.09 (123)	1.57± 0.12 (222)
55-64	1.69± 0.08 (130)	1.57± 0.08 (182)
Totals	1.67± 0.10 (852)	1.58± 0.12 (1166)

The mean weight of the study population was 56.4 ± 10.55kg. The mean weight of the men in the study population was 58.39 ± 11.34kg as compared to 54.80 ± 9.84kg for the women (median weights were 59kg and 54kg respectively). Except among the respondents under 25 years of age, the mean weight of the males in the study population was greater across age groupings than for the females in the study population (Table 8)

Table 8. Mean weight of the study population

	Mean Weight ± SD (kg)	
Age/years	**Male**	**Female**
15-24	54.39± 12.12 (293)	53.42± 8.92 (271)
25-34	63.18± 10.07 (162)	58.01±10.43(247)
35-44	60.78± 7.63 (144)	56.15± 9.80 (244)
45-54	59.89± 13.16 (123)	54.06± 9.11 (222)
55-64	57.39± 10.03 (130)	51.57± 9.80 (182)
Totals	58.39± 11.43 (852)	54.80± 9.84 (1166)

4.2.6 Obesity - Body mass index (BMI)

The BMI was used to classify the study population by virtue of their nutritional status. The BMI, derived from the ratio of weight in kilogrammes and the square of height in metres partitioned the respondents as follows (Table 9). The BMI is not a suitable for the evaluation of individuals under the age of 25 years because at that age one may not be fully developed to ones full potential in height. Therefore this data was re-examined without the inclusion of data from the group aged 15-24 years. Almost three percent of the study population (2.7%) was obese, 10% was overweight and the remaining had a BMI of below 25. The proportion of females that were obese was greater than for males across all age groupings examined in the study population. The mean value for BMI was 21.3 ± 3.24 kg/m^2.

Table 9. The prevalence of obesity among the study population as defined by their body mass indices

	Obese BMI≥30 (%)			Not obese BMI<30 (%)		
Age/yrs	**male**	**female**	**total**	**male**	**female**	**total**
25-34	0.07	0.90	0.97	11.11	16.08	27.19
	(1)	(13)	(14)	(161)	(233)	(394)
35-44	0.07	0.62	0.69	9.87	16.15	26.02
	(1)	(9)	(10)	(143)	(234)	(377)
45-54	0.21	0.41	0.62	8.21	14.91	23.12
	(3)	(6)	(9)	(119)	(216)	(335)
55-64	0.07	0.35	0.41	8.83	12.15	20.98
	(1)	(5)	(6)	(128)	(176)	(304)
Total	0.41	2.28	2.69	38.03	59.28	97.31
	(6)	(33)	(39)	(551)	(859)	(1410)

Trend for males; χ^2=2.82, p<0.42
Trend for females; χ^2=2.80 p<0.42

Three quarters (75.4%) of the study population was classified as normal with respect to their BMI whilst 15.7% was undernourished. The rest (8.9%) were overweight with 1.4% being obese. No significant relationship was evident between age and the prevalence of obesity among either sex. The prevalence of obesity was very low (2.69%) among this population and thus may have obscured any possible trends.

4.2.7 Central obesity - Waist-hip ratio (WHpR)

A total of sixty-two female respondents who indicated that they were pregnant at the time of the study did not have a waist girth measurement taken. A higher proportion of females were found to be centrally obese by this index than in the male population sampled.

Table 10. The prevalence of obesity among the study population as defined by their waist-hip ratios

	Centrally Obese (%)			Not centrally obese (%)		
Age/yrs	**male**	**female**		**male**	**female**	
	WHpR>0.90	**WHpR>0.85**	**total**	**WHpR<0.90**	**WHpR<0.85**	**total**
15-24	1.69	4.40	6.09	13.30	8.49	21.79
	(33)	(86)	(119)	(260)	(166)	(426)
25-34	0.72	4.19	4.91	7.57	6.96	14.53
	(14)	(82)	(96)	(148)	(136)	(284)
35-44	0.97	6.09	7.06	6.39	5.78	12.17
	(19)	(119)	(138)	(125)	(113)	(238)
45-54	1.59	6.19	7.77	4.65	5.06	9.72
	(31)	(121)	(152)	(91)	(99)	(190)
55-64	1.84	6.24	8.08	4.81	3.07	7.88
	(36)	(122)	(158)	(94)	(60)	(154)
Total	6.80	27.11	33.91	36.73	29.36	66.09
	(133)	(530)	(663)	(718)	(574)	(1292)

Trend for males; $\chi^2=24.08$, $p<0.00$
Trend for females; $\chi^2=60.59$ $p<0.00$

Whilst the prevalence of central obesity was below 2% among males, the figure was 4-6.25% among the female population. Generally, the prevalence of obesity increased with age among the population sampled. There was indication of a linear relationship between the age and prevalence of central obesity among females and males (χ^2=24.08, p<0.00, χ^2=60.59 p<0.00). Overall, 6.8% of the male population was found to be centrally obese, as compared to 27.11% in the female population (Table 10).

4.3.5 Blood pressure

Elevated systolic blood pressure above 140mmHg, diastolic blood pressure measurement above 90mmHg and self-reported hypertension treatment were indicators by which study participants were classified to be hypertension. Three successive measurements of an individual's systolic and diastolic blood pressure were taken with a minimum of five minutes rest spacing each reading. The average of the second and third reading were reported and analyzed for the purposes of this survey.

Thirty-four (34) individuals indicated that they were currently being treated for hypertension; data is presented without the inclusion of the self-reported hypertensives. The mean systolic blood pressure was 113mmHg and the mean diastolic blood pressure was found to be 73.7mmHg among the study population.

About 95% of the population had a mean systolic blood pressure below 140mmHg while about 93% had a diastolic blood pressure below 90mmHg. These results did not change markedly when the self-reported hypertensive individuals were excluded from the study population (Tables 11 & 12).

Table 11. The prevalence of hypertension among the study population as defined by the systolic blood pressure

Age/yrs	Hypertensive BP>140mmHg (%)			Normotensive BP≤ 140mmHg (%)		
	male	female	total	male	female	total
15-24	0.10	0.10	0.20	14.68	13.42	28.10
	(2)	(2)	(4)	(291)	(266)	(557)
25-34	0.25	0.15	0.40	7.92	12.11	20.03
	(5)	(3)	(8)	(157)	(240)	(397)
35-44	0.35	0.35	0.71	6.76	11.60	18.37
	(7)	(7)	(14)	(134)	(230)	(364)
45-54	0.40	0.45	0.86	5.65	10.34	15.99
	(8)	(9)	(17)	(112)	(205)	(317)
55-64	1.26	1.11	2.37	5.15	7.82	12.97
	(25)	(22)	(47)	(102)	(155)	(257)
Total	2.37	2.17	4.54	40.16	55.30	95.46
	(47)	(43)	(90)	(796)	(1096)	(1892)

Trend for males; χ^2=63.63, p<0.00
Trend for females; χ^2=48.13 p<0.00

The data was then partitioned by age to determine if the rate of hypertension seen was uniform across all age groups. A significant linear relationship was observed between the age of respondent and the prevalence of hypertension among both males and females using both systolic and diastolic blood pressure cutoffs (classification by systolic BP χ^2=63.63, p<0.00, χ^2=48.13 p<0.00; classification by diastolic BP χ^2=31.77, p<0.00 χ^2=22.92 p<0.00 respectively). Careful examination of data shows an increase in proportion of hypertensives in higher age brackets. For the age 35-64 years; the prevalence rates were 4.0% and 5.6% using the systolic and diastolic cutoffs respectively and for the individuals above 45 years; 10.1% and 10.4%. The mean systolic blood pressure among the population over 45 years of age was 117.6 ± 16.6 mmHg (males- 119.9 ± 17.6mmHg and females- 116.1 ± 15.8mmHg) and the mean diastolic blood pressure was 76.0 ± 18.0mmHg (males- 78.3 ± 13.5mmHg and females- 74.5 ±

10.7mmHg). On the average, the prevalence of hypertension was higher among the male population than that of the female population across all age groups. A similar trend was observed for the prevalence of hypertension using the diastolic blood pressure cutoffs (Table 12).

Table 12. The prevalence of hypertension among the study population as defined by the diastolic blood pressure

Age/yrs	Hypertensive BP> 90mmHg (%)			Normotensive BP≤ 90mmHg (%)		
	male	female	total	male	female	total
15-24	0.45	0.25	0.71	14.33	13.32	27.65
	(9)	(5)	(14)	(284)	(264)	(548)
25-34	0.50	0.40	0.91	7.67	11.86	19.53
	(10)	(8)	(18)	(152)	(235)	(387)
35-44	0.40	1.01	1.41	6.71	10.95	17.66
	(8)	(20)	(28)	(133)	(217)	(350)
45-54	0.55	0.50	1.06	5.50	10.29	15.79
	(11)	(10)	(21)	(109)	(204)	(313)
55-64	1.16	0.96	2.12	5.20	7.97	13.17
	(23)	(19)	(42)	(103)	(158)	(261)
Total	3.08	3.13	6.21	39.40	54.39	93.79
	(61)	(62)	(123)	(781)	(1078)	(1859)

Trend for males; χ^2=31.77, p<0.00
Trend for females; χ^2=22.92 p<0.00

Presented below is a summary of the main findings of this study designed to investigate the prevalence of risk factors of non-communicable disease in Kassena-Nankana district (Table 13). Total prevalence for male and females was computed by weighting the sex-specific prevalence to reflect the actual sex composition of the population[32].

Table 13. Summary of main findings

Risk Factor	Population Prevalence (%)	Prevalence (%)		Odds Ratio
		male	female	
Tobacco use	20.91	34.74	10.81	4.39
Alcohol use	55.03	66.27	46.83	2.23
Obesity (BMI)	2.69	1.08	3.70	0.28
Central obesity	33.91	15.63	48.01	0.2
Hypertension				
Diastolic	4.54	7.24	5.44	1.5
Systolic	6.21	5.58	3.78	1.37
Physical inactivity	10.51	5.88	13.89	0.39

CHAPTER FIVE

DISCUSSION AND CONCLUSION

As reported previously, tobacco use was more prevalent among the male population. An odds ratio of 4.39 indicates that men were more likely to use tobacco than women were in the Kassena-Nankana district (Table 13). Prevalence of tobacco use was found to be almost 21% in the district. This is higher than was found[33] almost a decade ago among a relatively urban population (15.1%). Researchers in the Gambia[34] among a stratified cluster-sampled population, found that smoking was more common among the urban than among the rural population, with more men using tobacco than women. Rural smoking referred to the smoking of tobacco leaves and snuff dipping whilst urban tobacco use implied the use of cigarettes only. The variety of tobacco products available in the rural areas was also observed in this study as well as the significantly higher smoking prevalence among the male population. Two previous studies conducted in Ghana also documented higher prevalence among the male population. Figures for males and females were 32.0 % and 5.9%; 24.0% and 0.8% respectively. The findings from this study are 34.7% and 10.8% (Table 13) for males and females respectively. The former figure seems comparable to that of the documented findings[33,34,35] whereas the latter (that for females) is markedly higher than reported[33]. In our study population, only a single female out of a total of one hundred and twenty six who used tobacco, smoked cigarettes (Table 3). Since the above studies were performed in urban areas where cigarettes are the predominant form of tobacco used, this may be the reason why prevalence among women may have been relatively low as compared to the findings in Kassena-Nankana district. Perhaps women prefer to use a less obvious product and where it is available the prevalence rate is higher.

Unlike tobacco, for which any level of exposure; active or passive is injurious, the level of risk involved in alcohol consumption varies linearly with consumption level[18]. In this study, the prevalence of alcohol use among male and female respondents was 66.3% and 46.8% respectively (Table 13). A relatively larger proportion of females used alcohol than tobacco products. It was also observed that males were only twice as likely to use alcohol as the women were. Alcohol consumption was high in the district (prevalence of 55%). A similar trend of high prevalence of alcohol use was observed[36] in community-based surveys conducted in Ethiopia, Vietnam and Indonesia. The consumption of alcohol and tobacco increases the risk of cancer at all sites[37] especially mouth and oesophageal. Several workers[38,39] observed a high prevalence of cancers of the buccal cavity among rural and urban dwellers who used both of these products. The abundance of locally brewed pito and the early age at which respondents begin to indulge in pito drinking may be factors contributing to the high prevalence rate observed.

Though the prevalence of obesity using the BMI cut-off was low, when the WHpR index a measure of fat distribution was used, a high prevalence of central obesity became evident. The WHpR is indicative of both subcutaneous and intra abdominal tissue and like the BMI, being above the cut-off is indicative of an increased risk of cardiovascular disease and related mortality[31]. In a West African rural population that was surveyed[34], obesity among men and women was determined to be 0.1% and 1.1% however the prevalence of central obesity in this population was determined to be 33.9%. This observation is similar to what was observed in data from Kassena-Nankana district (Table 13).

Fruits play a dual role in the diet; they provide insoluble fibre that decreases the gut residence time of toxins and carcinogens ingested in food and also are a rich

source of many protective phytochemicals such as antioxidants that prevent oxidative cell damage. Though the study population did not consume much fruit their diet is rich in insoluble fibre sources such as unpolished grains (millet, sorghum and corn) even in the lean season. Though the protective effect of consuming fruits and vegetables has been established through cohort and case-control studies, their effects are much weaker than the causative effects of smoking[37] and other risk factors of non-communicable disease. Therefore in a community such as this, an intervention program aimed at reducing alcohol and tobacco prevalence will be more effective than education programs geared towards diet modification.

In a largely rural population such as Kassena-Nankana district that has a high proportion of subsistent farmers with high level of physical activity, one would not expect a high prevalence of hypertension. The odds ratios indicated that though males had a higher tendency to become hypertensive than the females, this difference was not significant (1.5 and 1.3 times higher likelihood). The prevalence of undiagnosed hypertension in the study population was 4.5% and 6.2% the diastolic and systolic blood pressure cut-offs. This compares to what was observed[40,34] almost a decade ago amongst rural Ghanaian and Gambian adults (4.5% and 4.0% respectively).

In conclusion, this study conducted in the Kassena-Nankana district, documented the prevalence of the risk factors; tobacco, alcohol, physical inactivity, fruit intake, obesity and hypertension; a biochemical outcome of the risk factors enumerated. When the self-reported hypertensives are considered together with the proportion of undiagnosed hypertensives in the population, the prevalence of hypertension will increase to approximately 6.3-7.8% and these figures are much higher than was reported[40]. Therefore hypertension in this population is of public health concern if one takes into account the fact that this is a community-based survey and that the

prevalence figures would be lower than in a hospital-based survey or age specific prevalence figures (e.g. for above 45 year olds). In addition, such figures of hypertension prevalence in a very active community whose diet has not been influenced by global trends; low fibre, high simple sugar, high unsaturated fat, raises concerns for neighbouring urban communities such.

Due to the findings, it is necessary to monitor more accurately the incidence and prevalence of non-communicable diseases such as cardiovascular diseases; stroke and heart disease, cancers, lung, oesophageal, liver and oral, and diabetes. The levels of risk factors for non-communicable disease realized in this study cannot be ignored because they are not insignificant but rather suggest a public health problem. The combination of data of disease prevalence and trends of risk factor prevalence collected over a period, would paint an accurate picture of the potential problem.

CHAPTER SIX

RECOMMENDATIONS

The following are several recommendations that are being made in light of the findings of this study in order to prevent the increase of risk factors of non-communicable disease in the community;

Recommendations to the Kassena-Nankana DHMT

- A more detailed study that will evaluate serum cholesterol levels and determine the prevalence of undiagnosed diabetes in the community is needed, as its outcome would support the findings of this study.
- The establishment of a program to collect accurate data on risk factor and disease prevalence periodically so as to be able to inform health policy concerning non-communicable disease. This could be done in part through collaboration with the NHRC-NDSS to obtain community-based prevalence as well as related mortality data to complement the part of the program that would collect similar data from the sub-district health posts.
- The promotion of community-based programs that stress the importance of healthy lifestyle: reduction of tobacco and alcohol use. Sustained education campaigns through the media would be most effective as a large proportion (76.6%) of the population own radios; both rural and urban dwellers.

Recommendations to the Ghana Health Service (Health Research and Disease Surveillance Units)

- There is every indication from the findings of this community-based survey in a rural population of Kassena-Nankana district that there is the need to

institute a functional and comprehensive national non-communicable diseases surveillance programme. A programme that is comprehensive in that it collects data on

  - Disease prevalence (Disease registers)
  - Risk factor prevalence
  - Outcome of disease

- There is the need to introduce and support low-cost, low technology early detection programmes for non-communicable diseases into rural areas to ease the inequity in health care in our nation e.g. Cervical screening by visual inspection with acetic acid (VIA).
- There is the need to conduct behavioural research on optimising behaviour to achieve healthy lifestyles as well as research into psychosocial aspects that influence adherence to early detection programmes and long-term treatments. Several of our intervention programmes have faced these problems (e.g. TB dots) and therefore research into this area is necessary to achieve the needed success.
- To promote a national tobacco eradication programme; this will necessitate a multi-factor approach involving
  - Government imposed taxes on tobacco imports
  - Provision of agricultural alternatives that are equally rewarding to tobacco farmers
  - Effective public education strategies to increase public awareness of the hazards of cigarette smoking

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APPENDIX ONE

In case of reply the number and date of this letter should be quoted.

My Ref. : NHRCIRBM/04/2003
Your Ref. No.

Institutional Review Board
Navrongo Health Research Centre
Ghana Health Service
P. O. Box 114
Navrongo, Ghana
Tel: +233-742-22651
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April 12, 2003

Dr. Yvonne Mensa-Wilmot
School of Public Health
University of Ghana
Legon

Dear Dr. Mensa-Wilmot

Approval Letter: "Risk factors for Non-Communicable Diseases" protocol.

On April 12th 2003, the Navrongo Health Research Centre Institutional Review Board reviewed and approved the above protocol which was submitted for ethical review.

The Board does not recognise any serious ethical issues with the protocol and is of the view that carrying out this study would benefit the research community.

However, as was pointed out during the presentation, there is the need for you and your research team to restructure the questionnaire. There are a lot of additions that you need to make in order to achieve the objectives of this study. Based on the recommendations we made, please submit a revised questionnaire to the IRB Administrator by April 19th 2003.

If you have any questions, please contact Ms. Paulina Tindana or Mr. Raymond Aborigo, the IRB administrators, at the Navrongo Health Research Centre.

Sincerely,

Dr. Joseph Amankwa
Chair, NHRC-IRB

CC: Director, NHRC

APPENDIX TWO

CODE OF PATIENT:

NAVRONGO HEALTH RESEARCH CENTRE
COMMUNITY BASED SURVEY- RISK FACTORS FOR NON COMMUNICABLE DISEASE

(ADULT HEALTH STUDY)

CONSENT FORM

(To be translated into local dialect and read to Parent or Main Carer of child before enrollment)

Patient name:	
Permanent ID:	Compound ID:
Date:	

Dr. Mensa-Wilmot and Dr. Baiden, and their colleagues and field staff, all of NHRC, have described the study to me and explained that I am eligible to participate in this survey. They have explained that the survey is being undertaken to determine the risk factors for non-communicable diseases in the Kassena-Nankana district.

It has been explained that questions will be asked of me regarding my tobacco use, alcohol consumption, eating habits and general daily activities. The following measurements will also be taken of me;

blood pressure
height and weight
waist and hip girth.

In addition, I may be required to give a blood sample for biochemical/ lipid profile analysis. The sample taken shall be used solely for the lipid profile analysis.

I have also been made to understand that these measurements and information will allow the estimation of the risk of future occurrence of chronic disease such as diabetes, hypertension, chronic respiratory disease in the Kassena-Nankana district.

I understand that if as a result of measurements taken in this study I am deemed to require medical attention for a chronic illness, I will be referred to the nearest Health Centre for treatment. A physician has been specifically detailed to take care of me when I get there. I understand that I will receive care based on Ministry of Health, Ghana standard protocols and guidelines.

If I have any questions about the study, I can ask Dr Mensa-Wilmot, Dr Baiden or any of their colleagues and field staff at any time. I understand I have the right to withdraw from the study at any time. I have been reassured that all information obtained about me as a result of this study will be strictly confidential and used only for the purposes of this study.

Name of Respondent		Name of Witness	
Signature or Right Thumb-print of Respondent		Signature or Right Thumb-print of Witness	

APPENDIX THREE

RISK FACTORS FOR NON-COMMUNICABLE DISEASE SURVEY

QUESTIONNNAIRE (JUNE 2003)

Interviewer Code: **Date:** / / **2003**

SECTION 1 : Identification

1) District _____ 2) Sub District _____

3) Cluster _____ 4) Compound _____

PLEASE INTRODUCE YOURSELF BY STATE THAT YOU ARE HERE TO ASK A FEW QUESTIONS AND TAKE SOME MEASUREMENTS FOR THE ADULT HEALTH SURVEY OF WHICH THEY HAD PREVIOUSLY BEEN INFORMED.

5) Consent has been read out to respondent **Yes / No**

6) Language _____

5) Respondent's Full Name/ Code _____

SECTION 2 : Demographic Data

6) Gender (as observed) **M** **F**

7) Age of Respondent _____ *Don't Know 77*

8) Marital Status Single_____ Married_____ Separated_____ Divorced_____ Widowed_____

9) Are you currently employed ? **Yes / No** If no → skip to question 11

10) Where are you currently employed ?

- Managerial _____
- Clerical _____
- Sales _____
- Service _____
- Agricultural _____
- Production _____

11) Have you ever attended school ? **Yes / No** If no → skip to question 15

12) What is the highest level you completed ?

- Primary _____
- Middle School_____
- Secondary _____

Polytechnic / Vocational _____

University _____

13) What level did you attain ?

Primary _____

Middle School_____

Secondary _____

Polytechnic / Vocational _____

University _____

14) How many years have you spent in school (excluding preschool) _____yrs

(Don't Know 77)

15) Do you have a zinc roof ? **Yes / No**

16) What of these kind of flooring do you have in your home ?

Earth/ Dung _____

Wood _____

Cement _____

Vinyl _____

Terrazzo _____

Ceramic _____

Parquet _____

Carpet _____

17) Do you possess any of these items ?

a. Bicycle **Yes / No**

b. Radio **Yes / No**

c. Television **Yes / No**

d. Automobile **Yes / No**

SECTION 3 : Tobacco Use

18) Do you currently use any **tobacco products**; cigarettes, cigars or pipes ? **Yes / No**

If **No** → skip to question 24

	cigarettes	hand-rolled cigarettes	pipe tobacco	chewing tobacco	tobacco powder	other	other
19) Which of these products do you currently use *If none, skip to question 24*							
20) Which of these products do you currently use **daily** ? *If no, skip to question 24*							
21) How old were you when you **first started** to use these poducts? *Don't remember 77*							
22)Do you remember how long ago it was (in yrs and mnths) ?							
23) On average **how many** do you consume a day ? *Record for each type* *Don't remember 77*							

SECTION 4 : Alcohol Use

24) Have you **ever consumed** a drink that contains alcohol such as beer, spirit, palm wine, pito, akpeteshie? **Yes / No**

If **No** → skip to question 29

	beer	akpeteshie	palmwine	pito	other	other	other
25) Which of these products do you currently use *If none, skip to question 29*							
26) Which of these products did you use in the past 12 months ? *If no, skip to question 29*							
27) In the past 12 months, **how frequently** have you had at least one alcohol drink ? 5 or more days a week _____ 1-4 days per week _____ 1-3 days a month _____ Less than once a month _____ *Don't remember 77*							
28) When you drink alcohol, **on average**, how many drinks do you have during one day ? Less than 1 _____ Between 1-2 _____ Between 3-4 _____ More than 4 _____ *Don't remember 77*							

29) During each of the past 7 days, how many standard drinks of alcoholic drink did you have each day ? *(Record for each type)*

Monday _____ Tuesday _____ Wednesday_____

Thursday _____ Friday _____ Saturday _____

Sunday _____ *(Code 77 for Don't Know and 88 for refused)*

SECTION 5 : Physical Activity

*Think about all the vigorous activities that you did in **the last 7 days.** **Vigorous** Physical activities refer to activities that take hard physical effort and make you breathe harder than normal. Think **only** about those physical activities that you did for at least 10 mins at a time.*

30) During the last **7 days,** on how many days did you do **vigorous physical activities** such as lifting, digging or fast bicycling ? _____days per week

No vigorous physical activities → skip to question 30)

31) How much time did you usually spend doing **vigorous physical activities** on one of those days _____hours per day _____minutes per day

(Don't know/not sure 77)

*Think about all the moderate activities that you did in **the last 7 days.** **Moderate** Physical activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think **only** about those physical activities that you did for at least 10 minutes at a time.*

32) During the last **7 days,** on how many days did you do **moderate physical activities** such as carrying light loads, bicycling at a regular pace ? Do not include walking.

_____days per week

No moderate physical activities → skip to question 32)

33) How much time did you usually spend doing **moderate physical activities** on one of those days _____hours per day _____minutes per day

(Don't know/not sure 77)

*Think about all the time that you spent **walking** in **the last 7 days. This includes at work and at home, walking to travel from place to place and any other walking that you might do solely for recreation, exercise or leisure.***

34) During the last **7 days,** on how many days did you walk **at least** 10 minutes at a time ?

_____days per week No walking → skip to question 34)

35) How much time did you usually spend walking on one of those days

_____hours per day _____ minutes per day *(Don't know/not sure 77)*

*Think about all the time that you spent **sitting** in **the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting visiting friends or watching television.***

36) During the last **7 days**, on how much time did you **spend sitting** on a **week day ?**

_____hours per day _____minutes per day

(Don't know/not sure 77)

SECTION 6: Nutrition

Food frequency data

37) In the past 7 days, can you tell me about how many times you ate *(ask for all foods listed in the table)*

FOOD ITEMS	Code	None	1-2 days in a week	≥ 3 days in a week
a. Yam and yam products				
b. Cassava and cassava products				
c. Oranges				
d. Water Melons				
e. Mangoes				
f. Palm oil				
g. Fried foods (fish, plantain, koose etc)				
h. Pineapples				
I. Shea butter				
j. Millet and millet products				
k. Shea Fruit				
l. Dawadawa				
m. Guava				
n. Tubani o. Maize and maize products p. Beans and bean-based foods				

Food Recall Data

38) Can you list for me all the foods that you ate yesterday and approximately how much of each food item you ate, beginning with the morning meal until the evening meal ?

MEAL	Foods eaten	Source	Ingredients	Quantities
Breakfast				
Snacks				
Lunch				
Snacks				
Dinner				
Snacks				

SECTION 7 : Physical Measurements

WEIGHT & HEIGHT

Technician ID Code: _____

Device for Height ID Code..... Device for Weight ID Code.....

Height in centimeters : _____ Weight in Kg : _____

Height in centimeters : _____ Weight in Kg : _____

WAIST & HIP

39) Participant currently pregnant, to be answered by women only. No _____

(if yes, skip waist) Yes _____

Uncertain _____

Waist Circumference in centimeters: (1) _____ (2) _____

Hip Circumference in centimeters: (1)_____ (2)_____

PULSE RATE AND BLOOD PRESSURE

40) Are you currently on treatment for hypertension ? **Yes / No**

Reading 1:_____ Bpm:_____

Reading 2:_____ Bpm:_____

Reading 3:_____ Bpm:_____

Device ID Code _____ Technician ID Code: _____

Cuff Size (circle what applies) Small 1 Normal 2 Large 3

Reading 1: Systolic BP mmHg _____ Diastolic BP mmHg:_____

Reading 2: Systolic BP mmHg _____ Diastolic BP mmHg:_____

Reading 3: Systolic BP mmHg _____ Diastolic BP mmHg:_____

SECTION 8 : Biochemical Measurements

Device ID Code _____ Technician ID Code:_____

Total cholesterol _____._____ mmol/l

APPENDIX FOUR

Registration of potential respondents

Obtaining a signature from a male respondent

Interviewing several respondents at Gia

Obtaining information from a female respondent

Obtaining a Height Measurement

Obtaining a Weight Measurement

Obtaining a blood pressure measurement with a digital device

Obtaining a blood sample for lipid profile analysis